Volume II

DEVELOPMENT OF TECHNIQUES AND ASSOCIATED INSTRUMENTATION FOR HIGH TEMPERATURE EMISSIVITY MEASUREMENTS

APPENDIX A, BIBLIOGRAPHY

NAS8-26304

Lockheed

MISSILES & SPACE COMPANY

A GROUP DIVISION OF LOCKHEED AIRCRAFT CORPORATION

SUNNYVALE, CALIFORNIA

Volume II

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FIRST QUARTERLY PROGRESS REPORT
FOR THE PERIOD
29 JUNE 1970 TO 30 SEPTEMBER 1970

INTRODUCTION

The references and abstracts contained in this bibliography have been obtained from two computer-search services available to LMSC through its Technical Information Center facility. Those references with accession numbers starting with "A," "N," or "X" were obtained from the NASA/RECON (Acronym for REmote CONsole) information retrieval service. Those with accession numbers starting with "AD-" were obtained from the Defense Documentation Center (DDC) retrieval service. The overall scope for both searches was for references pertinent to the subject of emittance of high temperature materials. Additional qualifying modifiers included reentry vehicles, heat shields, radiant heat transfer in hypersonic flows, measurement methods, and reentry simulation.

The NASA literature search number was 12990, titled "Emittance of High Temperature Materials," dated 3 September 1970. This search contained a total of 492 references of which approximately 100 appeared to be pertinent to the particular materials and problems of concern to this study and are listed herein. These references with accession numbers starting with "A" cite published literature references which have been announced in the International Aerospace Abstracts, (IAA) dating back to 1962. After the accession number, the format is as follows: issue and page number of IAA, category, meeting paper or report numbers, contract numbers, date of document, document classification, title, notation of content, authors, name of publication, place of publication, name of publisher, date, collation, language (if not in English), and the subject index terms.

These references with accession numbers starting with "N" cite report literature references which have been announced in the Scientific and Technical Aerospace Reports, (STAR) or which have not been announced elsewhere. After the accession

number the format is as follows: issue and page number of STAR, category, report numbers, contract numbers, date of report, report classification, title, notation of content, authors, a corporate source identifying code number, corporate source, the corporate source supplemental, date of the report, collation, availability, price, and subject index terms.

Those references with accession numbers starting with "X" cite report literature references which have distribution limitations, e.g., for NASA Only or U.S. Government Agency Only. The format for these references is the same as for "N" numbered references above.

The DDC references to Department of Defense reports were obtained from two searchs numbered 045518 and B45506, both titled "Emittance of High Temperature Materials," and dated 21 August 1970 and 27 August 1970, respectively. These searchs contained a total of 867 references of which approximately 65 appeared to be to pertinent reports which were not listed in the NASA search report. The format for these "AD-" numbered references is similar to that for the NASA report literature references, but in addition usually includes a short abstract paragraph at the end.

The references listed herein have been grouped into eight subject categories to give an approximate indication of the principal content of the report which is of interest to this study. These categories are as follows:

(1) Concerning high temperature emittance characteristics of refractory and other high temperature metals and alloys
(2) Concerning high temperature emittance characteristics of ceramics and high temperature coating materials
(3) Concerning the high temperature emittance characteristics of carbon, graphites, ablative materials and chars
(4) Concerning the emittance and absorptance of high temperature gases encountered during atmospheric reentrys
(5) Concerning measurement methods for high temperature and material emittance determinations

(6) Concerning radiative heat transfer to and from vehicles in high-velocity, reentry-type environments

(7) Concerning reentry simulation techniques and facilities

(8) Concerning the design and performance of high temperature heat shields

GROUP 1

Concerning high temperature emittance characteristics of refractory and other high temperature metals and alloys.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-853 926L 11/6 20/4 11/3
MCDONNELL DOUGLAS ASTRONAUTICS CO ST LOUIS MO EASTERN DIV
TANTALUM SYSTEMS EVALUATION. (U)
DESCRIPTIVE NOTE: INTERIM TECHNICAL REPT. NO. 12, 1 FEB-1 MAY 69,
MAY 69 42P JACKSON,ROBERT E. 1
CONTRACT: AF 33(615)-3935

UNCLASSIFIED REPORT
DISTRIBUTION: CONTROLLED: ALL REQUESTS TO DIRECTOR, AIR FORCE FLIGHT DYNAMICS LAB., ATTN: FDTS. WRIGHT-PATTERSON AFB, OHIO 45433.

DESCRIPTORS: (*TANTALUM ALLOYS, LEADING EDGE), (*LEADING EDGE, EMISSIVITY), NIOBIUM ALLOYS, REFRACTORY COATINGS, TUNGSTEN, TUNGSTEN COMPOUNDS, SILICIDES, AERODYNAMIC HEATING, REENTRY VEHICLES, ATMOSPHERE ENTRY, STAGNATION POINT, COATINGS, GLASS, SLURRY COATING, THERMAL EXPANSION, INERT GAS WELDING, TUNGSTEN, ELECTRON BEAM WELDING, NICKEL ALLOYS, COBALT ALLOYS, LOADING(MECHANICS), STRUCTURAL PROPERTIES, FLAT PLATE MODELS, CREEP, BENDING (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-812 801 11/6 20/6 20/13
AIR FORCE MATERIALS LAB WRIGHT-PATTERSON AFB OHIO
EFFECT OF SURFACE ROUGHNESS ON THE REFLECTANCE OF REFRACTORY METALS. (U)
DESCRIPTIVE NOTE: TECHNICAL REPT. 1 MAY 65-1 MAY 66,
DEC 66 78P STEVISON,DONALD F. 1
REPT. NO. AFML-TR-66-232
PROJ: AF-7381
TASK: 738102

UNCLASSIFIED REPORT
DISTRIBUTION: NO FOREIGN WITHOUT APPROVAL OF AIR FORCE MATERIALS LAB., ATTN: MAAE. WRIGHT-PATTERSON AFB, OHIO 45433.

DESCRIPTORS: (*REFRACTORY METALS, SURFACE ROUGHNESS), MEASUREMENT, OPTICAL PROPERTIES, THERMAL PROPERTIES, NIOBIUM ALLOYS, TANTALUM, TUNGSTEN, EMISSIVITY, REFLECTIVITY, HEAT TRANSFER, THERMAL RADIATION, DESIGN, SURFACE TEMPERATURES, TEST METHODS, REFLECTION (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 845506

AD-705 344 11/6 14/2
NATIONAL BUREAU OF STANDARDS WASHINGTON D C PHYSICAL CHEMISTRY DIV
HIGH-SPEED (SUBSECOND) MEASUREMENT OF HEAT CAPACITY, ELECTRICAL RESISTIVITY, AND THERMAL RADIATION PROPERTIES OF MOLYBDENUM IN THE RANGE 1900 TO 2800 K. (U)
OCT 69 30P CEZAIRLIYAN,A. ;MORSE,M. S. ;BERMAN,H. A. ;BECKETT,C. W. ;
PROJ: AF-9750
TASK: 975001
MONITOR: AFOSR 70-1111TR

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN JNL. OF RESEARCH OF THE NATIONAL BUREAU OF STANDARDS-A. PHYSICS AND CHEMISTRY, V74A N1 P65-92 JAN/FEB 70.

DESCRIPTORS: (*MOLYBDENUM, PHYSICAL PROPERTIES), RESISTANCE(ELECTRICAL), THERMAL RADIATION, SPECIFIC HEAT, PYROMETERS, THERMODYNAMICS (U)

A TECHNIQUE IS DESCRIBED FOR THE HIGH-SPEED MEASUREMENT OF HEAT CAPACITY, ELECTRICAL RESISTIVITY, HEMISPHERICAL TOTAL AND NORMAL SPECTRAL EMITTANCES OF ELECTRICAL CONDUCTORS AT HIGH TEMPERATURES (ABOVE 1900 K) WITH MILLISECOND RESOLUTION. DURATION OF AN INDIVIDUAL EXPERIMENT, IN WHICH THE SPECIMEN IS HEATED FROM ROOM TEMPERATURE TO CLOSE TO ITS MELTING POINT, IS LESS THAN ONE SECOND. TEMPERATURE MEASUREMENTS ARE MADE WITH A HIGH-SPEED PHOTOELECTRIC PYROMETER. QUANTITIES ARE RECORDED BY A HIGH-SPEED DIGITAL DATA ACQUISITION SYSTEM WHICH HAS A RESOLUTION OF APPROXIMATELY ONE PART IN 8000. TIME RESOLUTION OF THE ENTIRE SYSTEM IS 0.4 MS. RESULTS ON THE ABOVE PROPERTIES OF MOLYBDENUM IN THE TEMPERATURE RANGE 1900 TO 2800 K ARE REPORTED AND ARE COMPARED WITH THOSE IN THE LITERATURE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-698 357 11/6
CINCINNATI UNIV OHIO MATERIALS SCIENCE PROGRAM
THE THERMAL CONDUCTIVITY AND TOTAL EMITTANCE OF TUNGSTEN AT 1800 TO 2800K. (U)
DESCRIPTIVE NOTE: TECHNICAL REPT. 1 SEP 67-30 JUN 68, OCT 69 52P JUN,C. K, IEBRAHIM,SALMAN IHOCH,M. ;
CONTRACT: F33615-67-C-1445
PROJ: AF-7367
TASK: 736704
MONITOR: AFML TR-69-275

UNCLASSIFIED REPORT

DESCRIPTORS: (*HIGH-TEMPERATURE RESEARCH, TUNGSTEN), (*TUNGSTEN, PHYSICAL PROPERTIES), THERMAL CONDUCTIVITY, EMISSIVITY, CASTINGS, POWDER METALLURGY, CONDUCTION(HEAT TRANSFER), TRANSPORT PROPERTIES, DETERMINATION, TEST EQUIPMENT, ERRORS, SPECIAL FUNCTIONS(MATHEMATICAL), STANDARDS (U)
IDENTIFIERS: EMITTANCE (U)

THE THERMAL CONDUCTIVITIES AND TOTAL EMITTANCES OF SIX TUNGSTEN SAMPLES PREPARED BY DIFFERENT MANUFACTURERS USING EITHER ARC-CAST METHODS OR POWDER METALLURGY TECHNIQUES WERE MEASURED IN THE TEMPERATURE RANGE 2000 - 2800K. THE THERMAL CONDUCTIVITY OF COMMERCIALLY PREPARED ARC-CAST SAMPLES IS SLIGHTLY HIGHER THAN THE THERMAL CONDUCTIVITY OF COMMERCIALLY PREPARED POWDER METALLURGY SAMPLES. IN BOTH CASES THE THERMAL CONDUCTIVITY IS INDEPENDENT OF TEMPERATURE. THE TOTAL EMITTANCE AT 2500K FOR THE POWDER METALLURGY SAMPLES IS 0.25 AND 0.29 FOR THE ARC-CAST SAMPLES. THE SPECIALLY PREPARED MATERIALS HAVE THERMAL CONDUCTIVITIES AND EMITTANCES WHICH ARE DIFFERENT FROM THE CONDUCTIVITY AND EMITTANCE OF COMMERCIALLY AVAILABLE MATERIALS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-477 224 11/6
CINCINNATI UNIV OHIO
THERMAL CONDUCTIVITY OF TANTALUM, TUNGSTEN AND TANTALUM-TUNGSTEN ALLOYS. (U)
DESCRIPTIVE NOTE: TECHNICAL REPT. SEP 64-MAR 65, MAY 65 27P JUN ,C. K. IHOCH,M. I
CONTRACT: AF33(615)-1759
PROJ: AF-7367
TASK: AF-736704
MONITOR: AFML TR-65-191

UNCLASSIFIED REPORT
DISTRIBUTION: NO FOREIGN WITHOUT APPROVAL OF RESEARCH AND TECHNOLOGY DIV. (AFSC), WRIGHT-PATTERSON AFB, OHIO. 45433. ATTN: AFML.

DESCRIPTORS: (*REFRACTORY METALS, THERMAL PROPERTIES), (*REFRACTORY METAL ALLOYS, THERMAL PROPERTIES), TANTALUM, TANTALUM ALLOYS, TUNGSTEN, TUNGSTEN ALLOYS, THERMAL CONDUCTIVITY, SPECIFIC HEAT, EMISSIVITY, TABLES, EXPERIMENTAL DATA (U)
IDENTIFIERS: TANTALUM ALLOY 1OW (U)

THE THERMAL CONDUCTIVITY K, AND THE RATIO OF SPECIFIC HEAT TO TOTAL EMITTANCE CP/EPSILON, OF TANTALUM, TUNGSTEN, AND TA-1OW ALLOY WERE MEASURED IN THE TEMPERATURE RANGE 1500-2200 K. THE AVAILABLE DATA ON THE SPECIFIC HEAT OF TANTALUM, TUNGSTEN, AND THE TA-1OW ALLOY, WHICH ARE NEEDED TO CONVERT DIFFUSIVITY MEASUREMENT TO CONDUCTIVITY VALUES, ARE ALSO GIVEN. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-601 315
CINCINNATI UNIV OHIO
THERMAL CONDUCTIVITY AND TOTAL EMISSIVITY MEASUREMENTS IN THE TEMPERATURE RANGE 1000-3000 C. (U)
DESCRIPTIVE NOTE: REPT. FOR DEC 62-FEB 64,
APR 64 19P HOCH,MICHAEL I
CONTRACT: AF33 616 7123
PROJ: 7367
TASK: 736704
MONITOR: ML TDR64 59

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*GRAPHITE, THERMAL PROPERTIES), (*REFRACTORY METALS, THERMAL PROPERTIES), TANTALUM, TUNGSTEN, MOLYBDENUM, NIOBIUM, THERMODYNAMICS, SPECIFIC HEAT, EMISSIVITY, THERMAL CONDUCTIVITY, MEASUREMENT (U)

THE RATIO OF THERMAL CONDUCTIVITIES AND OF THERMAL CONDUCTIVITIES TO TOTAL EMISSIVITIES WERE MEASURED FOR ANISOTROPIC ZT-TYPE GRAPHITE IN THE TEMPERATURE RANGE 1000-2000 C. THE EMISSIVITY OF A SAMPLE CHANGES EVEN IF IT IS STORED AT ROOM TEMPERATURE FOR A LONG TIME. TO OBTAIN THE TOTAL EMISSIVITY OF A MATERIAL, THE RATIO OF SPECIFIC HEAT TO TOTAL EMISSIVITY IS DETERMINED FOR TANTALUM, TUNGSTEN, MOLYBDENUM, AND NIOBIUM IN THE TEMPERATURE RANGE 1000-2000 C. IN ALL CASES, IT IS FOUND THAT SPECIFIC HEAT/TOTAL EMISSIVITY IS A CONSTANT, INDEPENDENT OF TEMPERATURE. THIS PERMITS AN EASY AND ACCURATE DETERMINATION OF THE TOTAL EMISSIVITY OF ANY MATERIAL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-414 194
CINCINNATI UNIV OHIO
RELATION BETWEEN SPECIFIC HEAT AND EMISSIVITY OF TANTALUM AT ELEVATED TEMPERATURES. (U)
DESCRIPTIVE NOTE: FINAL REPT., JULY 61-DEC 62,
IV
CONTRACT: AF 33(616)-7123
PROJ: AF-7367
TASK: 736704
MONITOR: ASD TDR-63-371

UNCLASSIFIED REPORT

DESCRIPTORS: (*REFRACTORY METALS AND ALLOYS, TANTALUM), (*TANTALUM, EMISSIVITY), SPECIFIC HEAT, MEASUREMENT, HIGH TEMPERATURE RESEARCH, EXPERIMENTAL DATA, TABLES. (U)
IDENTIFIERS: 1963. (U)

THE RATE OF COOLING IN VACUUM OF TANTALUM CYL INDERS OF VARIOUS SIZES HAS BEEN STUDIED IN THE TEMPERATURE RANGE 1850 TO 1300 K. THE RATIO OF SPECIFIC HEAT, C SUB P, TO TOTAL EMISSIVITY, EPSILON, WAS FOUND TO BE CONSTANT: C SUB P/EP SILON 0.226 = 0.004 CAL/GM/DEGREE K.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-607 530
AMERICAN MACHINE AND FOUNDRY CO ALEXANDRIA VA ALEXANDRIA DIV
COATED REFRACTORY METAL EMITTANCE SPECIMENS. (U)
DESCRIPTIVE NOTE: REPT. FOR 1 MAY 63-29 FEB 64,
AUG 64 78P LEAVENWORTH,H. W. ;JR.;
SCHATZ,E. A. ;BROWNING,M. E. ;DUNKERLEY,F. J. ;

CONTRACT: AF33 657 11330
PROJ: 7381
TASK: 738103
MONITOR: ML , TDR64 148

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*REFRACTORY METAL ALLOYS, COATINGS), (*COATINGS, REFRACTORY METAL ALLOYS), THERMAL RADIATION, EMISSIVITY, SURFACE PROPERTIES, STABILITY, NIOBIUM ALLOYS, TUNGSTEN ALLOYS, ZIRCONIUM ALLOYS, CARBON ALLOYS, TANTALUM ALLOYS, VANADIUM ALLOYS, MOLYBDENUM ALLOYS, SILICON COATINGS, SILICIDES, CHROMIUM, DIFFUSION, ALUMINUM, BORON, SPECTROGRAPHY, CHEMICAL ANALYSIS, OXIDATION, REFRACTORY COATINGS, REFLECTION, PHOTOMICROGRAPHY, REENTRY VEHICLES, THERMAL PROPERTIE(U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-466 356
GENERAL ELECTRIC CO PHILADELPHIA PA MISSILE AND SPACE DIV
TOTAL HEMISPHERICAL EMITTANCE OF OXIDIZED HEAT RESISTANT ALLOYS, (U)
AUG 64 30P DESANTIS,V. J. I
REPT. NO. R64SD60

UNCLASSIFIED REPORT
DDC USERS
SUPPLEMENTARY NOTE:

DESCRIPTORS: (*HEAT-RESISTANT METALS + ALLOYS, EMISSIVITY), (*COATINGS, HEAT-RESISTANT METALS + ALLOYS), STAINLESS STEEL, NICKEL ALLOYS, CHROMIUM ALLOYS, MOLYBDENUM ALLOYS, COBALT ALLOYS, TUNGSTEN ALLOYS, THERMOELECTRICITY, HEAT TRANSFER, TEMPERATURE, VACUUM, X-RAY DIFFRACTION ANALYSIS, OXIDES, FILMS, CHROMIUM COMPOUNDS, ADHESION (U)
IDENTIFIERS: HASTELLOY (ALLOY), HAYNES ALLOY 25, STAINLESS STEEL 304, STAINLESS STEEL 19-9DL, HASTELLOY N, CHROMIUM (III) OXIDE (U)

THIS REPORT GIVES A DESCRIPTION OF THE EXPERIMENTAL WORK LEADING TO THE DEVELOPMENT OF A PROCESS TO PRODUCE STABLE HIGH EMISSIVITY COATINGS ON SELECTED STAINLESS STEEL AND SUPER ALLOY BASE METALS. THE THREE (3) ALLOYS STUDIED WERE TYPE 304 STAINLESS STEEL, HASTELLOY N AND HAYNES ALLOY 25. A GENERAL DESCRIPTION OF THE METHOD USED IN MEASURING TOTAL HEMISPHERICAL EMISSIVITY IS GIVEN ALONG WITH THE DETERMINATION OF THE STABILITY OF EMISSIVITY AT TEMPERATURES IN EXCESS OF 800 C IN VACUUM OF 0.000005 TORR OR LESS. RESULTS OF TESTS DESIGNED TO DETERMINE COATING ADHERENCE AND MECHANICAL INTEGRITY ARE GIVEN. A REVIEW OF THE PERTINENT LITERATURE IS PRESENTED IN APPENDIX I. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-299 417
MARQUARDT CORP VAN NUYS CALIF
EMITTANCE STUDIES OF VARIOUS HIGH TEMPERATURE MATERIALS AND COATINGS (U)
MAR 63 1V SKLAREW,S.;
REPT. NO. PR 281 3Q 1
CONTRACT: AF33 657 8707

UNCLASSIFIED REPORT

DESCRIPTORS: *COATINGS, *HEAT RESISTANT MATERIALS, ALUMINUM COMPOUNDS, BLACKBODY RADIATION, CARBIDES, COBALT COMPOUNDS, EMISSIVITY, EQUATIONS, EXPERIMENTAL DATA, FLAME SPRAYING, GRAPHITE, HIGH-TEMPERATURE RESEARCH, IRON COMPOUNDS, JET FLAMES, LOW-PRESSURE RESEARCH, MANGANESE COMPOUNDS, NICKEL COMPOUNDS, OXIDES, REFRACTORY COATINGS, SILICON COMPOUNDS, TANTALUM, TITANIUM ALLOYS (U)

EMITTANCE STUDIES OF VARIOUS HIGH TEMPERATURE MATERIALS AND COATINGS.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-297 685
AEROJET-GENERAL CORP AZUSA CALIF
EMITTANCE OF HAYNES CB 752 AND FANSTEEL ALLOYS (U)
AUG 62 1V HILL,C.D.;
REPT. NO. M-2119
MONITOR: IDEP 502.30.00.25-A7-02

UNCLASSIFIED REPORT
NOFORN

DESCRIPTORS: *NIOBIUM ALLOYS, DETERMINATION, EMISSIVITY, HIGH-TEMPERATURE RESEARCH, TANTALUM ALLOYS (U)

SPECTRAL AND TOTAL EMITTANCE OF HAYNES CB 752 AND FANSTEEL 82 ALLOYS AT TEMPERATURES FROM 1800 TO 3000 F.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-294 345
BATTELLE MEMORIAL INST COLUMBUS OHIO DEFENSE METALS INFORMATION CENTER
THERMAL RADIATIVE PROPERTIES OF SELECTED MATERIAL (U)
NOV 62 1V WOOD,W.D.;DEEM,H.W.;LUCKS,C.F.;
REPT. NO. 177 V1
CONTRACT: AF33 616 7747

UNCLASSIFIED REPORT

DESCRIPTORS: *HEAT RESISTANT METALS + ALLOYS, CHROMIUM, CHROMIUM ALLOYS, COBALT, COBALT ALLOYS, DATA, IRON, IRON ALLOYS, METALS, MOLYBDENUM, MOLYBDENUM ALLOYS, NICKEL, NICKEL ALLOYS, NIOBIUM, NIOBIUM ALLOYS, REFRACTORY MATERIALS, STAINLESS STEEL, TANTALUM, TANTALUM ALLOYS, THERMAL RADIATION, TITANIUM, TITANIUM ALLOYS, TUNGSTEN, TUNGSTEN ALLOYS (U)

THERMAL RADIATIVE PROPERTIES OF SELECTED MATERIALS. COMPILATION. TI AND TI ALLOYS. STAINLESS STEEL. FE-, NI-, CO-BASE SUPERALLOYS, REFRACTORY METALS AND THEIR ALLOYS.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-269 784
BATTELLE MEMORIAL INST COLUMBUS OHIO DEFENSE METALS INFORMATION CENTER
THE EMITTANCE OF CHROMIUM, COLUMBIUM, MOLYBDENUM, TANTALUM, AND TUNGSTEN (U)
DEC 61 1V WOOD,W.D.;DEEM,H.W.;LUCKS,C.F.;
REPT. NO. M141

UNCLASSIFIED REPORT

DESCRIPTORS: *CHROMIUM, *MOLYBDENUM, *NIOBIUM, *TANTALUM, *THERMAL RADIATION, *TUNGSTEN, ABSORPTION, ALLOYS, BLACKBODY RADIATION, BRIGHTNESS, DATA, EMISSIVITY, HEAT TRANSFER, METALS, MONOCHROMATIC LIGHT, OPTICAL EQUIPMENT, RADIATION PYROMETERS, REFLECTION, SPECTROPHOTOMETERS, TABLES, TEST EQUIPMENT, THERMIONIC EMISSION, THERMISTORS, THERMOCOUPLES (U)

A COMPILATION IS PRESENTED OF ORIGINAL TEST DATA ON EMITTANCE, REFLECTANCE, AND ADSORPTANCE OF CR, NB, MO, TA, AND W. THE DATA WERE TAKEN FROM THE LITERATURE PUBLISHED DURING THE PERIOD 1940-1959 INCLUSIVE, AND AS MUCH OF THE 1960 LITERATURE AS COULD BE OBTAINED. THE FOLLOWING SOURCES WERE SEARCHED: CHEMICAL ABSTRACTS, CERAMIC ABSTRACTS, METALLURGICAL ABSTRACTS, NUCLEAR SCIENCE ABSTRACTS, AND THE FILES OF THE DEFENSE METALS INFORMATION CENTER (DMIC). AN ATTEMPT WAS MADE TO EVALUATE THESE SOURCES OF DATA ACCORDING TO THE APPARENT THOROUGHNESS OF METHODS AND TECHNIQUES AS DESCRIBED BY THE VARIOUS INVESTIGATORS. IN MANY CASES THE DESCRIPTIONS IN THE LITERATURE ARE A SUMMARY OF METHODS AND RESULTS, AND A COMPLETE EVALUATION IS IMPOSSIBLE. CURVES ARE PRESENTED WHICH APPEAR TO INDICATE THE MOST PROBABLE VALUES FOR THE VARIOUS CONDITIONS AND MATERIALS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-246 276
LITTLE (ARTHUR D) INC CAMBRIDGE MASS
INFRARED SPECTRAL EMITTANCE PROPERTIES OF SOLID MATERIALS (U)
OCT 60 IV BLAU,HENRY H. JR.;MARSH,JOHN B.;
CONTRACT: AF19 604 2433
MONITOR: AFCRL TR-60-416

UNCLASSIFIED REPORT
NOFORN

DESCRIPTORS: *INFRARED RADIATION, *REFRACTORY MATERIALS, *SOLAR FURNACES, BLACKBODY RADIATION, INFRARED SPECTROSCOPY, LABORATORY FURNACES, MEASUREMENT, SPECTROGRAPHIC ANALYSIS (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-697 761 14/2
PURDUE UNIV LAFAYETTE IND THERMOPHYSICAL PROPERTIES RESEARCH CENTER
DETERMINATION OF THERMAL AND ELECTRICAL CONDUCTIVITY, EMITTANCE AND THOMSON COEFFICIENT AT HIGH TEMPERATURES BY DIRECT HEATING METHODS. (U)
DESCRIPTIVE NOTE: TECHNICAL REPT. 1 JUL 68-30 JUN 69, OCT 69 71P TAYLOR,RAYMOND E. ;DAVIS, FREDERICK E. ;POWELL,REGINALD W. ;KIMBROUGH, WILBUR D. ;
CONTRACT: F33615-69-C-1229
PROJ: AF-7381
TASK: 738106
MONITOR: AFML TR-69-39-277

UNCLASSIFIED REPORT

DESCRIPTORS: (*HIGH-TEMPERATURE RESEARCH, THERMAL CONDUCTIVITY), (*THERMAL CONDUCTIVITY, MEASUREMENT), RADIATION PYROMETERS, MEASURING DEVICES(ELECTRICAL + ELECTRONIC), HEATING, ELECTRIC CURRENTS, ELECTRICAL CONDUCTANCE, EMISSIVITY, DATA PROCESSING SYSTEMS, SURFACE TEMPERATURES, VOLTAGE, ACCURACY, TANTALUM, TUNGSTEN, PYROLYTIC GRAPHITE (U)
IDENTIFIERS: RESISTANCE HEATING, OPTICAL PYROMETERS, THERMOPHYSICAL PROPERTIES, SPECTRAL EMITTANCE, COMPUTATION, REPRODUCIBILITY, TEMPERATURE PROFILES, THOMSON COEFFICIENT (U)

PROGRESS ON A PROGRAM FOR EVALUATING DIRECT ELECTRICAL HEATING METHODS FOR HIGH TEMPERATURE THERMAL CONDUCTIVITY DETERMINATIONS IS PRESENTED. RECENT MODIFICATIONS, WHICH INCREASED THE TEMPERATURE CAPABILITIES OF THE APPARATUS, PROTECTED THE SAMPLES FROM CONTAMINATION AND IMPROVED THE ACCURACY AND SIMPLICITY OF THE MEASUREMENTS, ARE DESCRIBED. A METHOD FOR CALCULATING THE THERMAL CONDUCTIVITY USING ANY THREE TEMPERATURE VERSUS POSITION DATA POINTS (3-POINT METHOD) OF A TEMPERATURE PROFILE WAS DEVISED. USING THIS 3-POINT METHOD, HUNDREDS OF CONDUCTIVITY VALUES CAN BE CALCULATED PER TEMPERATURE PROFILE. COMPUTATIONAL SCHEMES WHICH UTILIZE MULTIPLE DATA POINTS OR THE OUTPUT OF THE 3-POINT PROGRAM ARE BEING DEVELOPED. SUBSTANTIAL IMPROVEMENT IN THE ACCURACY AND REPRODUCIBILITY OF THE COMPUTED THERMAL CONDUCTIVITY VALUES HAS BEEN OBTAINED USING THESE SCHEMES. IN ADDITION, VALUES FOR THE THOMSON COEFFICIENT ARE DERIVED. DATA ON THERMAL CONDUCTIVITY, TOTAL HEMISPHERICAL EMITTANCE, SPECTRAL EMITTANCE (0.65 (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-434 755
BOEING CO SEATTLE WASH
EVALUATION OF CB-752 COLUMBIUM ALLOY (CB-10 PERCENT W-2.5 PERCENT ZR), (U)
MAR 63 48P BAGGERLY,R. G. ;TORGERSON,R. T. ;
REPT. NO. D2 35105

UNCLASSIFIED REPORT
NOFORN
SUPPLEMENTARY NOTE:

DESCRIPTORS: (*NIOBIUM ALLOYS, MECHANICAL PROPERTIES), (*REENTRY VEHICLES, MATERIALS), HIGH-TEMPERATURE RESEARCH, TENSILE PROPERTIES, CREEP, MATERIAL FORMING, DUCTILITY, BRITTLENESS, TRANSITION TEMPERATURE, WELDING, PROTECTIVE TREATMENTS, OXIDATION, EMISSIVITY, SILICIDES, MICROSTRUCTURE, RECRYSTALLIZATION, CHEMICAL ANALYSIS, TUNGSTEN ALLOYS, ZIRCONIUM ALLOYS (U)
IDENTIFIERS: 1963, NIOBIUM ALLOY CB-752 (U)

AN EVALUATION OF HAYNES-STELLITE CB-752 COLUMBIUM ALLOY (CB-10W-2.5ZR) HAS BEEN CONDUCTED TO ESTABLISH ITS POTENTIAL AS A STRUCTURAL MATERIAL FOR RE-ENTRY VEHICLES. PROPERTIES WHICH WERE INVESTIGATED INCLUDE TENSILE PROPERTIES TO 3000F, CREEP PROPERTIES TO 3000 F, FORMABILITY, DUCTILE BRITTLE TRANSITION TEMPERATURE, FUSION WELDING, PROTECTIVE COATING, OXIDATION RESISTANCE AND EMITTANCE. TESTING WAS CONDUCTED 0.010 TO 0.035 IN. SHEET FROM THREE HEATS OF MATERIAL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-419 028
CALIFORNIA UNIV BERKELEY INST OF ENGINEERING RESEARCH
THERMAL RADIATION PROPERTIES OF MATERIALS, PART III. (U)
DESCRIPTIVE NOTE: FINAL REPT.,
AUG 63 68P SEBAN,R.A.;
CONTRACT: AF33 657 7793
PROJ: 7360
TASK: 736001
MONITOR: WADD TR60 370, PT. 2

UNCLASSIFIED REPORT

DESCRIPTORS: (*METALS, THERMAL RADIATION), (*ALLOYS, THERMAL RADIATION), (*THERMAL RADIATION, METALS), MATERIALS, EMISSIVITY, PLATINUM, NICKEL, MOLYBDENUM, COPPER, NICKEL ALLOYS, CHROMIUM ALLOYS, STAINLESS STEEL, TITANIUM COMPOUNDS, DIOXIDES, OXIDATION, COATINGS, METAL COATINGS, ABSORPTION SPECTRUM. (U)
IDENTIFIERS: 1963. (U)

THE EFFECT OF TEMPERATURE ON THE NORMAL SPECTRAL EMITTANCE IN THE RANGE FROM 1 TO 15 MICRONS IS DEMONSTRATED FOR CERTAIN POLISHED METALS AND SOME OXIDIZED AND COATED METALS BY A COMPARISON OF ABSORPTANCES MEASURED AT ROOM TEMPERATURE AND EMITTANCES MEASURED AT TEMPERATURES OF THE ORDER OF 2000 TO 2500 R. THE EMITTANCES WERE OBTAINED IN A SYSTEM DESIGNED AND CONSTRUCTED IN THE PRE VIOUS PHASE OF THIS RESEARCH AND THESE RESULTS ARE AFFECTED BY THE LESS THAN OPTIMUM OPERATION OF THIS SYSTEM, BY WHICH CONTAMINATION OF THE SAMPLE OCCURRED, IRREGULARLY BUT CONSISTENTLY. THE RESULTS FOR PT, NI, AND FE REVEAL AT HIGH TEMPERATURE THE CORRESPONDENCE WITH THE HAGEN RUBENS LAW WHICH IS IMPLIED BY AVAILABLE RESULTS ON THE TOTAL NORMAL EMITTANCE, THOUGH THE COR RESPONDENCE IN THIS SPECTRAL RANGE MUST BE AT TRIBUTED TO ANOMALOUS EFFECTS. WITH OXIDES AND WITH COATED MATERIALS THE EFFECT OF TEMPERA TURE ON THE SPECTRAL VALUES APPEARS TO BE SMALL AND LOCALIZED, THOUGH WITH SOME MATERIALS THESE ARE INDICATIONS OF PERMANENT CHANGES IN THE EMITTANCE AS THE PERIOD OF EXPOSURE TO HIGH TEMPERATURE IS INCREASED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-298 061
SOUTHERN RESEARCH INST BIRMINGHAM ALA
THE THERMAL PROPERTIES OF TWENTY-SIX SOLID MATERIALS TO 5000 DEGREES F OR THEIR DESTRUCTION TEMPERATURES (U)
1V PEARS,C.D.;OGLESBY,SABERT;
CONTRACT: AF33 616 7319
MONITOR: ASD TDR62 765

UNCLASSIFIED REPORT

DESCRIPTORS: *HEAT RESISTANT METALS + ALLOYS, *REFRACTORY MATERIALS, BORIDES, CARBIDES, DENSITY, ELECTRICAL PROPERTIES, EMISSIVITY, GRAPHITE, MECHANICAL PROPERTIES, MICROSTRUCTURE, MOLYBDENUM ALLOYS, NIOBIUM ALLOYS, NITRIDES, OXIDES, THERMAL CONDUCTIVITY, THERMAL EXPANSION, THERMOELECTRICITY (U)

THERMAL PROPERTIES OF 26 SOLID MATERIALS TO 5000 F OR THEIR DESTRUCTION TEMPERATURES.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-297 865
NAVAL RADIOLOGICAL DEFENSE LAB SAN FRANCISCO CALIF
TOTAL NORMAL AND TOTAL HEMISPHERICAL EMITTANCE OF POLISHED METALS - PART II (U)
JAN 63 1V ABBOTT,G.L.;ALVARES,N.J.;PARKER, W.J.;
MONITOR: ASD TR61 94 P2

UNCLASSIFIED REPORT

DESCRIPTORS: *RESISTANCE (ELECTRICAL), DATA, DESIGN, EMISSIVITY, HIGH-TEMPERATURE RESEARCH, MICROSTRUCTURE, MOLYBDENUM, PLATINUM, RADIATION MEASUREMENT SYSTEMS COMPONENTS (U)

TOTAL NORMAL AND TOTAL HEMISPHERICAL EMITTANCE OF POLISHED MOLYBDENUM AND PLATINUM.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45504

AD-436 887
NAVAL RADIOLOGICAL DEFENSE LAB SAN FRANCISCO CALIF
TOTAL NORMAL AND TOTAL HEMISPHERICAL EMITTANCE OF POLISHED METALS. PART III. (U)
DESCRIPTIVE NOTE: REPT. FOR 27 FEB-19 DEC 62.
DEC 63 37P ABBOTT,G. L. ;
PROJ: 7360
TASK: 736001
MONITOR: WADD TR61 94, PT. 3.

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON THE CHEMISTRY AND PHYSICS OF MATERIALS.

DESCRIPTORS: (*REFRACTORY METALS, EMISSIVITY), (*EMISSIVITY, REFRACTORY METALS), THERMAL RADIATION, NIOBIUM, TANTALUM, TUNGSTEN, HIGHTEMPERATURE RESEARCH, TEMPERATURE, RESISTANCE (ELECTRICAL), MEASUREMENT, SURFACES, INSTRUMENTATION, THERMOCOUPLES, MOLYBDENUM, PLATINUM (U)
IDENTIFIERS: THERMOPILE (U)

THE TOTAL HEMISPHERICAL EMITTANCE, THE TOTAL NORMAL EMITTANCE, AND THE VARIATION OF ELECTRICAL RESISTIVITY WITH TEMPERATURE WERE MEASURED ON AGED SURFACES OF TANTALUM, NIOBIUM, AND TUNGSTEN IN A VACUUM OVER A TEMPERATURE RANGE FROM 1000 K TO 3000 K (SUBJECT TO THE MATERIAL). IN ADDITION, THE NORMAL SPECTRAL EMITTANCE AT 0.65 MICRON WAS MEASURED ON TANTALUM AND NIOBIUM. THE TOTAL HEMISPHERICAL EMITTANCE WAS OBTAINED FROM THE MEASURED POWER DISSIPATION WITHIN THE UNIFORM TEMPERATURE REGION AT THE CENTER OF AN ELECTRICALLY HEATED RIBBON; ITS TEMPERATURE BEING MEASURED WITH A THERMOCOUPLE OR AN OPTICAL PYROMETER WHEN THE SPECTRAL EMITTANCE WAS KNOWN. THE TOTAL NORMAL EMITTANCE WAS DETERMINED BY USING A RADIATION THERMOPILE. THE RATIO OF TOTAL HEMISPHERICAL TO TOTAL NORMAL EMITTANCE WAS ALSO CALCULATED DIRECTLY FROM THE ANGULAR DISTRIBUTION OF RADIATION OBTAINED BY REVOLVING THE RIBBON WITHIN THE FIELD OF VIEW OF THE THERMOPILE. SOME DATA ARE ALSO INCLUDED ON MOLYBDENUM FROM A PREVIOUS REPORT. (AUTHOR) (U)

A70-22068 ISSUE 9 PAGE 1725 CATEGORY 23 00 /00/00 UNCLASSIFIED DOCUMENT

Tungsten emissive properties

(Tungsten emissivity and radiance properties obtained at high surface temperatures)

A/VUJNOVIC, V. (AA/ZAGREB, SVEUCILISTE, ZAGREB, YUGOSLAVIA/.)

OPTICAL SOCIETY OF AMERICA, JOURNAL, VOL. 60, P. 177-179. RESEARCH SUPPORTED BY THE YUGOSLAV FEDERAL FUND FOR SCIENTIFIC WORK.

/*EMISSIVITY/*RADIANCE/*SURFACE TEMPERATURE/*TUNGSTEN/ HIGH TEMPERATURE TESTS/ OPTICAL PATHS/ TEMPERATURE EFFECTS/ WAVELENGTHS

A70-19894 ISSUE 7 PAGE 1313 CATEGORY 17 AF 33/615/-67-C-1445 69/00/00 UNCLASSIFIED DOCUMENT

Thermal conductivity and total emittance of tantalum, tungsten, rhenium, Ta-10W, T111, T222, and W-25Re in the temperature range 1500-2800 K

(Thermal conductivities and total emittance of Ta, W, Re and alloys at high temperatures compared with NBS values)

A/HOCH, M.; B/JUN, C. K. (AA/CINCINNATI, U., CINCINNATI, OHIO/.)

LONDON, BUTTERWORTH AND CO. /PUBLISHERS/, LTD., SYMPOSIUM SUPPORTED BY THE INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY, THE ADVANCED RESEARCH PROJECTS AGENCY, THE U.S. AIR FORCE, THE U.S. ATOMIC ENERGY COMMISSION, THE NATIONAL SCIENCE FOUNDATION, AND NASA. IN- HIGH TEMPERATURE TECHNOLOGY, PROCEEDINGS OF THE THIRD INTERNATIONAL SYMPOSIUM, PACIFIC GROVE, CALIF., SEP. 17-20, 1967. P. 535-545. /A70-19876 07-17/

/*EMITTANCE/*REFRACTORY METAL ALLOYS/*REFRACTORY METALS/*TABLES (DATA)/*THERMAL CONDUCTIVITY/ CONFERENCES/ HIGH TEMPERATURE RESEARCH/ RHENIUM ALLOYS/ TANTALUM ALLOYS/ TEMPERATURE EFFECTS/ TUNGSTEN ALLOYS

A69-16447# ISSUE 5 PAGE 716 CATEGORY 6 68/ 12/00 UNCLASSIFIED DOCUMENT

Total and spectral emittance of cobalt.

(Total and spectral emittance of cobalt surface s conditioned by evaporating some cobalt from surf ace at high temperature in vacuo)

A/GOEL, T. C.; B/JAIN, S. C.; C/NARAYAN, V. (AB/INDIAN INST. OF TECH., NATIONAL PHYSICAL LAB. OF INDIA, NEW DELHI, INDIA/, AC/INDIAN INST. OF T ECH., NEW DELHI, INDIA/.)

COBALT, P. 191-195. 19 REFS.

/*COBALT/*EMITTANCE/*HIGH TEMPERATURE RESEARCH /*SPECTRAL EMISSION/ BLACK BODY RADIATION/ EVAPORA TION/ HOT SURFACES/ METAL SURFACES/ RADIATIVE HEAT TRANSFER/ SURFACE FINISHING/ SURFACE ROUGHNESS EF FECTS

A69-15894 ISSUE 5 PAGE 845 CATEGORY 33 68/ 06/00 UNCLASSIFIED DOCUMENT

Experimental study of the effect of the similar ity factor on the radiating power /emissivity/ of metals.

(Emissivity of rough metallic surfaces with pre served profile similarity, showing independence to roughness height)

A/GORDON, A. R.; B/KOVALEV, I. I.; C/MELNIKOV A, I. A.; D/TARTAKOVSKAIA, F. M.

HIGH TEMPERATURE, VOL. 6, P. 419-423. 10 REFS.

/TEPLOFIZIKA VYSOKIKH TEMPERATUR, VOL. 6, MAY-J UN. 1968, P. 436-441./ TRANSLATION.

/*EMISSIVITY/*METAL SURFACES/*SURFACE ROUGHNES S EFFECTS/ MOLYBDENUM/ NIOBIUM/ PYROMETERS/ STEFAN -BOLTZMANN LAW/ TEMPERATURE PROFILES

A68-29985# ISSUE 14 PAGE 2694 CATEGORY 33
68/05/00 UNCLASSIFIED DOCUMENT

Thermal conductivity of metals at high temperatures by the Jain and Krishnan method. I - Nickel.

(High temperature Ni thermal conductivity determined by improved Jain and Krishnan method, noting electrical conductivity and total and spectral emissivities)

A/GOEL, T. C.; B/JAIN, S. C. (AB/INDIAN INST. OF TECH., DEPT. OF PHYSICS, NATIONAL PHYSICAL LAB. OF INDIA, NEW DELHI, INDIA/ AA/INDIAN INST. OF TECH., DEPT. OF PHYSICS, NEW DELHI, INDIA/.)

JOURNAL OF PHYSICS, PART D - BRITISH JOURNAL OF APPLIED PHYSICS, VOL. 1, P. 573-580.

/*HIGH TEMPERATURE TESTS/*NICKEL/*THERMAL CONDUCTIVITY/ ELECTRICAL RESISTIVITY/ EMISSIVITY/ SPECTRAL EMISSION/ TEMPERATURE DISTRIBUTION/ TEMPERATURE EFFECTS

A65-22053 ISSUE 12 PAGE 1716 CATEGORY 17 AF 33/616/-7123 65/04/00 UNCLASSIFIED DOCUMENT

Relation between specific heat and total emittance in tantalum, niobium, tungsten, and molybdenum.

(Specific heat relation to total emittance in tantalum, niobium, tungsten and molybdenum)

A/HOCH, M.; B/IYER, A. S.; C/NARASIMHAMURTY, H. V. L. (AA/CINCINNATI, U., MATERIALS SCIENCE PROGRAM, CINCINNATI, OHIO/.)

JOURNAL OF PHYSICAL CHEMISTRY, VOL. 69, APR. 1965, P. 1420-1423.

/*RADIANT ENERGY/*REFRACTORY METAL/*SPECIFIC HEAT/ EMISSIVITY/ ENERGY/ HEAT/ HIGH TEMPERATURE/ MATERIAL/ METAL/ MOLYBDENUM/ NIOBIUM/ PREPARATION/ RADIANCE/ REFRACTORY/ SPECIFIC/ SURFACE/ TANTALUM/ TEMPERATURE/ THERMAL/ TOTAL/ TUNGSTEN/ VACUUM

A65-21438# ISSUE 11 PAGE 1574 CATEGORY 18
65/04/00 UNCLASSIFIED DOCUMENT

Normal spectral emissivity of isotropic and anisotropic materials.

(Crystallographic orientation effects on IR EMISSIVITY of isotropic nickel and anisotropic graphite at high temperatures)

A/AUTIO, G. W.; B/SCALA, E. (AB/CORNELL U., ITHACA, N.Y./.)

AIAA JOURNAL, VOL. 3, APR. 1965, P. 738-740. 9 REFS. ARPA-SUPPORTED RESEARCH.

/*CRYSTAL STRUCTURE/*GRAPHITE/*INFRARED RADIATION/*NICKEL/*RADIANT ENERGY/ ANISOTROPY/ CRYSTAL/ CRYSTALLOGRAPHY/ EMISSIVITY/ ENERGY/ HIGH TEMPERATURE/ INFRARED/ ISOTROPY/ NORMAL/ ORIENTATION/ RADIANCE/ RADIATION/ RESISTIVITY/ SPECTRUM/ STRUCTURE

A64-24480 ISSUE 20 CATEGORY 18 64/00/00 UNCLASSIFIED DOCUMENT

Determination and application of thermophysical properties of refractory metals.

(Thermal diffusion, emissivity, heat capacity, thermal conduction and heat induced structural changes in refractory metals)

A/RIECK, G. D. (AA/EINDHOVEN, TECHNICAL U., EINDHOVEN, NETHERLANDS/.)

IN- THE SCIENCE AND TECHNOLOGY OF TUNGSTEN, TANTALUM, MOLYBDENUM, NIOBIUM AND THEIR ALLOYS, PROCEEDINGS OF THE NATO AGARD CONFERENCE ON REFRACTORY METALS, OSLO U. CENTRE, OSLO, NORWAY, JUN. 23-26, 1963. EDITED BY N. E. PROMISEL. AGARDOGRAPH 82. OXFORD, PERGAMON PRESS, 1964, P. 205-217. 104 REFS.

/*HEAT EFFECT/*REFRACTORY METAL/*THERMOPHYSICAL PROPERTY/ CAPACITY/ CHANGE/ DIFFUSION/ EFFECT/ EMISSIVITY/ MOLYBDENUM/ NIOBIUM/ STRUCTURE/ TANTALUM/ TEMPERATURE/ THERMAL/ THERMOCONDUCTIVITY/ TUNGSTEN

N63-85106 62/00/00 UNCLASSIFIED DOCUMENT
A/PEARS, C. D.
SOUTHERN RESEARCH INST., BIRMINGHAM, ALA.
SOUTHERN RESEARCH INST., BIRMINGHAM, ALA. TH E DETERMINATION OF THE EMITTANCE OF REFRACTORY MAT ERIALS TO 5000 DEG F C. D. PEARS <1962< 28P PRES ENTED AT THE SECOND ASME SYMP. ON THERMOPHYSICAL P ROPERTIES, JAN. 1962
/ EMISSIVITY/ HIGH TEMPERATURE/ MATERIAL/ MEAS UREMENT/ REFRACTION

N69-23250# ISSUE 11 PAGE 1909 CATEGORY 17
68/00/00 UNCLASSIFIED DOCUMENT
Radiative properties of tantalum, molybdenum, n iobium, graphite and niobium carbide at high tempe ratures
(Radiative properties of tantalum, molybdenum, niobium, graphite, and niobium carbide at high tem peratures in infrared and visible regions)
A/KHRUSTALEV, B. A.
LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CAL IF. AVAIL- NATIONAL TRANSLATIONS CENTER, JOHN C RERAR LIBRARY, CHICAGO, ILL. 60616
TRANSL. INTO ENGLISH OF THE BOOK ''TEPLOOBM EN, GIDRODIN. I TEPLOFIZICH. SVOISTV VESHCHESTVA'' MOSCOW, NAUKA PRESS, 1968 P 198-219
/*GRAPHITE/*MOLYBDENUM/*NIOBIUM/*NIOBIUM CARBI DES/*RADIATIVE HEAT TRANSFER/*TANTALUM/ HIGH TEMPE RATURE/ INFRARED RADIATION/ LIGHT (VISIBLE RADIATI ON)/ THERMAL RESISTANCE

N69-13338# ISSUE 3 PAGE 489 CATEGORY 17 SM -74/224 68/11/14 UNCLASSIFIED DOCUMENT
Experimental study of the total hemispherical e missivity, electrical conductivity and coefficient s of thermal conductivity of several refractory me tals in the 1300-3000 deg K range
(Total emissivity, electrical resistivity, and coefficients of thermal conductivity of several re fractory metals in 1300 to 3000 deg K range)
A/TIMROT, D. L.
AIR FORCE SYSTEMS COMMAND, WRIGHT- PATTERSON AF B, OHIO. (FOREIGN TECHNOLOGY DIV.) AVAIL. CFS TI
IN ITS INTERN. SYMP. ON PRODUCTION OF ELEC. PO WER BY MEANS OF MHD GENERATORS 14 NOV. 1968 P 264 -271 /SEE N69-13314 03-03/
/*ELECTRICAL RESISTIVITY/*EMISSIVITY/*HIGH TEM PERATURE TESTS/*REFRACTORY METALS/*THERMAL CONDUCT IVITY/ CONFERENCES/ MAGNETOHYDRODYNAMIC GENERATORS

N68-14377# ISSUE 5 PAGE 674 CATEGORY 17 SC
-RR-66-576 67/08/00 UNCLASSIFIED DOCUMENT
Emittance values of Haynes-25 for a selected re
entry environment
(Emittance values for Haynes 25 for aerospace n
uclear safety reentry analyses)
A/DEVENEY, J. E.
SANDIA CORP., ALBUQUERQUE, N. MEX. (AEROSPACE
NUCLEAR SAFETY DEPT.) AVAIL. CFSTI
SPONSORED BY AEC
/*EMITTANCE/*STELLITE (TRADEMARK)/ AEROTHERMOD
YNAMICS/ COBALT ALLOYS/ EMISSIVITY/ HEAT RESISTANT
ALLOYS/ REACTOR SAFETY

N66-19501*# ISSUE 9 PAGE 1563 CATEGORY 33
NASA-CR-56496 PWA-2206, VOL. I NASW-104 62/00/
00 UNCLASSIFIED DOCUMENT
Determination of the emissivity of materials, V
olume I Interim final report, Jul. 1, 1959 - Dec.
31, 1962
(Thermal emittance of refractory metals, oxides
, carbides, and titanates for determining material
s for use in space radiators)
PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, CONN
. AVAIL. CFSTI
<1962< 273 P REFS
/*CARBIDE/*OXIDE/*REFRACTORY METAL/*SPACE RADI
ATOR/*THERMAL EMISSION/*TITANATE/ EMISSION/ EMISSI
VITY/ HIGH TEMPERATURE/ METAL/ RADIATOR/ REFRACTOR
Y/ SPACE/ THERMAL

N66-19499*# ISSUE 9 PAGE 1563 CATEGORY 33
NASA-CR-56497 PWA-2206, VOL. II NASW-104 62/00
/00 UNCLASSIFIED DOCUMENT
Determination of the emissivity of materials, V
olume II Interim final report, Jul. 1, 1959 - Dec
. 31, 1962
(Tables of thermal emittance data for refractor
y metals, oxides, carbides, and titanates)
PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, CONN
. AVAIL. CFSTI
<1962< 200 P
/*CARBIDE/*MATERIALS SCIENCE/*OXIDE/*REFRACTOR
Y METAL/*TABLE/*THERMAL EMISSION/*TITANATE/ EMISSI
ON/ EMISSIVITY/ MATERIAL/ OPTICAL/ PRESSURE/ PYROM
ETER/ RADIATOR/ REFRACTORY/ SCIENCE/ SPACE/ TEMPER
ATURE/ THERMAL/ TIME

N66-19490*# ISSUE 9 PAGE 1563 CATEGORY 33
NASA-CR-56498 PWA-2206, VOL. III NASW-104 62/0
0/00 UNCLASSIFIED DOCUMENT
Determination of the emissivity of materials, V
olume III Interim final report, Jul. 1, 1959 - De
c. 31, 1962
(Compilation of photographs and graphs relative
to determining thermal emittance of refractory me
tals, oxides, carbides, and titanates)
PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, CONN
. AVAIL. CFSTI
<1962< 180 P
/*CARBIDE/*GRAPH/*OXIDE/*PHOTOGRAPH/*REFRACTOR
Y METAL/*THERMAL EMISSION/*TITANATE/ EMISSIVITY/ E
QUIPMENT/ HEMISPHERE/ MATERIAL/ METAL/ RADIATOR/ R
EFRACTORY/ SCIENCE/ SPACE/ SUBSTRATE/ TEMPERATURE/
THERMAL/ TIME/ WAVELENGTH

N62-10835*# ISSUE 3 CATEGORY 21 PWA-1812 N
ASW-104 60/00/00 UNCLASSIFIED DOCUMENT
(Determination of emissivity of materials)
PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, CONN
.
PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, C
ONN. DETERMINATION OF EMISSIVITY OF MATERIALS. THI
RD QUARTERLY PROGRESS REPORT, JAN. 1, 1960 THROUGH
MAR. 1960. 82 P. 1 REF. /PWA-1812/ /NASA CONTRA
CT NASW-104/ AVAILABLE FROM OTS- PH $8.10, MI $2
.66.
/*EMISSION/*GRAPHITE/*MOLYBDENUM/*NIOBIUM/*OXI
DE/*PLATINUM BLACK/*STAINLESS STEEL/*VARNISH/ BEAM
/ BLACK/ CHARACTERISTICS/ DETECTOR/ DETERIORATION/
DETERMINATION/ EMISSIVITY/ LEAD/ LIGHT/ OPERATION
AL/ PHOTOMETER/ PLATINUM/ RIG/ SPECTRUM/ STAINLESS
/ STEEL/ SULFIDE/ TOTAL

N64-10961* ISSUE 2 CATEGORY 13 63/00/00 UN CLASSIFIED DOCUMENT

The total hemispherical emittance of platinum, columbium-1 percent zirconium, and polished and ox idized inor-8 in the range 100 deg to 1200 deg c

(Temperature dependence of hemispherical emitta nce of metal and alloy strips in 100- to 1200-deg c range using blackbody vacuum chamber)

A/KOLLIE, T. G.; B/MC ELROY, D. L.

OAK RIDGE NATIONAL LAB., TENN.

IN NASA MEASUREMENT OF THERMAL RADIATION PR OPERTIES OF SOLIDS 1963 P 365-379 REFS /SEE N64 -10937 02-01/ GPO- $3.50

/*ALLOY/*EMISSION/*REFRACTORY METAL/*TEMPERATU RE/*VACUUM CHAMBER/ BLACK/ BODY/ CHAMBER/ DEPENDEN CE/ EMISSIVITY/ HEMISPHERE/ HIGH TEMPERATURE/ LOW TEMPERATURE/ NIOBIUM/ PLATINUM/ STRIP/ VACUUM/ ZIR CONIUM

N63-11915# ISSUE 4 CATEGORY 13 DMIC-177, VOL . 1 AF 33/616/-7747 62/11/15 UNCLASSIFIED DO CUMENT

(Thermal radiative properties of selected mater ials including titanium alloys, stainless steels, superalloys, refractory metals, and coatings)

A/DEEM, H. W.; B/LUCKS, C. F.; C/WOOD, W. D.

BATTELLE MEMORIAL INST., COLUMBUS, OHIO. (DEF ENSE METALS INFORMATION CENTER)

DEFENSE METALS INFORMATION CENTER, BATTELLE MEMORIAL INST., COLUMBUS, OHIO THERMAL RADIATIVE P ROPERTIES OF SELECTED MATERIALS, VOLUME 1 W. D. WO OD, H. W. DEEM, AND C. F. LUCKS NOV. 15, 1962 19 2P 25 REFS /CONTRACT AF 33/616/-7747/ /DMIC-177, V OL. 1/

/*COATING/*MATERIAL TESTING/*RADIATIVE HEAT TR ANSFER/*REFRACTORY METAL/*STAINLESS STEEL/*SUPERAL LOY/*TITANIUM ALLOY/ ALLOY/ CERAMICS/ GRAPHITE/ HE AT TRANSFER/ HIGH TEMPERATURE/ MATERIAL/ MEASUREME NT/ METAL/ PROPERTY/ RADIATION/ RADIATIVE/ REFRACT ORY/ STAINLESS/ STEEL/ TEST/ THERMAL/ TITANIUM

N63-11916# ISSUE 4 CATEGORY 13 DMIC-177, VOL. 2 AF 33/616/-7747 62/11/15 UNCLASSIFIED DOCUMENT

(Thermal radiative properties of selected materials)

A/DEEM, H. W.; B/LUCKS, C. F.; C/WOOD, W. D.

BATTELLE MEMORIAL INST., COLUMBUS, OHIO. (DEFENSE METALS INFORMATION CENTER)

DEFENSE METALS INFORMATION CENTER, BATTELLE MEMORIAL INST., COLUMBUS, OHIO THERMAL RADIATIVE PROPERTIES OF SELECTED MATERIALS, VOLUME 2 W. D. WOOD, H. W. DEEM, AND C. F. LUCKS NOV. 15, 1962 280 P 11 REFS /FOR ABSTRACT SEE N63-11915 04-13/ /CONTRACT AF 33/616/-7747/ /DMIC-177, VOL. 2/

/*HIGH TEMPERATURE/*MATERIALS SCIENCE/*RADIATIVE HEAT TRANSFER/*THERMAL RADIATION/ ABSORPTION/ ALLOY/ CERAMICS/ CHROMIUM/ COATING/ COBALT/ GRAPHITE/ HEAT/ HEAT TRANSFER/ IRON/ MATERIAL/ MOLYBDENUM/ NICKEL/ NIOBIUM/ RADIATION/ RADIATIVE/ REFLECTION/ REFRACTORY/ STAINLESS/ STEEL/ SUPERALLOY/ TANTALUM/ THERMAL/ TITANIUM/ TUNGSTEN

N62-17018# ISSUE 18 CATEGORY 18 AF 33/616/-6841 ARPA ORDER 24-61 62/09/00 UNCLASSIFIED DOCUMENT

(Refractory materials research - vaporization and emissivity studies)

A/KIBLER, G. M.; B/LYON, T. F.

GENERAL ELECTRIC CO., CINCINNATI, OHIO. (FLIGHT PROPULSION LAB. DEPT.,)

FLIGHT PROPULSION LAB. DEPT., GENERAL ELECTRIC CO., CINCINNATI, OHIO REFRACTORY MATERIALS RESEARCH EIGHTH QUARTERLY PROGRESS REPORT /11 JULY 1962 - 30 SEPTEMBER 1962/ G. M. KIBLER AND T. F. LYON SEPT. 30, 1962 18 P 7 REFS /CONTRACT AF 33/616/-6841, ARPA ORDER 24-61/

/*EMISSION/*REFRACTORY MATERIAL/*TANTALUM NITRIDE/*VAPORIZATION/ ATMOSPHERE/ CHEMISTRY/ EMISSIVITY/ GRAPHITE/ ISOTHERM/ MATERIAL/ MEASUREMENT/ NITRIDE/ NITROGEN/ ORIFICE/ PARTICLE/ PRESSURE/ REFRACTORY/ RESEARCH/ TANTALUM/ TEMPERATURE

GROUP 2

Concerning high temperature emittance characteristics of ceramics and high temperature coating materials.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-838 766 11/2 20/13
MARTIN MARIETTA CORP ORLANDO FLA ORLANDO DIV
HIGH TEMPERATURE RADIANCE OF BORON NITRIDE FROM 1.87 TO 5.68 MICRONS. (U)
DESCRIPTIVE NOTE: TECHNICAL REPT. JAN-SEP 67.
NOV 67 109P DURAND,J. L. ;JOHNSON,L. S. ;
REPT. NO. OR-9017
CONTRACT: F08635-67-C-0055
MONITOR: AFATL TR-67-199

UNCLASSIFIED REPORT
DISTRIBUTION: NO FOREIGN WITHOUT APPROVAL OF AIR FORCE ARMAMENT LAB., ATTN: ATTI, EGLIN AFB, FLA. 32542.

DESCRIPTORS: (*BORON COMPOUNDS, THERMAL PROPERTIES), NITRIDES, REFRACTORY MATERIALS, THERMAL RADIATION, INFRARED RADIATION, EMISSIVITY, TEMPERATURE, RADIOMETERS, DEGRADATION, HEATING, NOSE CONES (U)
IDENTIFIERS: BORON NITRIDE, RADIANCE (U)

THE RADIANCE OF VARIOUS FORMS OF BORON NITRIDE WAS MEASURED IN AN AIRFLAME ENVIRONMENT IN TWO REGIONS OF THE INFRARED SPECTRUM (1.87 TO 2.82 MICRONS AND 2.98 TO 5.68 MICRONS) OVER A TEMPERATURE RANGE OF 800 TO 1950C. HEATING WAS ACCOMPLISHED WITH AN OXYGEN-ACETYLENE FLAME AT ATMOSPHERIC PRESSURE. MOISTURE RESISTANT HOT PRESSED BORON NITRIDE WITHSTOOD CONTINUOUS HIGH TEMPERATURE EXPOSURE AT 1800C WITHOUT SEVERE DEGRADATION, WHILE PYROLYTIC BORON NITRIDE SUCCESSFULLY WITHSTOOD CONTINUOUS EXPOSURE AT 1800C. THE MEASURED RADIANCE-TEMPERATURE CURVE OF HOT PRESSED BORON NITRIDE AGREED CLOSELY WITH VALUES COMPUTED FROM EMISSIVITY DATA, WHILE SIMILAR DATA FOR PYROLYTIC BORON NITRIDE SIGNIFICANTLY EXCEEDED THAT MEASURED FOR THE HOT PRESSED FORM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B46506

AD-627 237 7/4 11/2
ARMY MATERIALS RESEARCH AGENCY WATERTOWN MASS MATERIALS ENGINEERING DIV
INFRARED RADIATION OF SOLIDS - TITANIUM-BORONITRIDE, (U)

DEC 65 16P GRENIS,ALBERT F. ;LEVITT, ALBERT P. ;
REPT. NO. AMRA-TR-65-30
PROJ: DA-1A014501B32A

UNCLASSIFIED REPORT

DESCRIPTORS: (*CERAMIC MATERIALS, SPECTRA(INFRARED)), (*SPECTRA(INFRARED), CERAMIC MATERIALS), COMPOSITE MATERIALS, TITANIUM, BORON COMPOUNDS, NITRIDES, INFRARED PHENOMENA, EMISSIVITY, SOLID STATE PHYSICS, THERMAL RADIATION, THEORY, HIGH-TEMPERATURE RESEARCH, MOLECULAR PROPERTIES, MOLECULAR WEIGHT, BLACKBODY RADIATION, TITANIUM COMPOUNDS (U)

THE INFRARED RADIATION PROPERTIES AND CHARACTERISTICS OF TITANIUM-BORONITRIDE WERE INVESTIGATED IN THE WAVELENGTH REGION EXTENDING FROM 1.0 TO 10.0 MICRONS AT A TEMPERATURE OF 1300 K. THE NORMAL SPECTRAL EMISSIVITY, INTEGRATED NORMAL TOTAL EMISSIVITY, AND INFRARED RADIATION INTENSITY CURVES OF THIS MATERIAL FOR TWO DIFFERENT SURFACE CONDITIONS WERE DETERMINED. ADDITIONAL RADIATION STUDIES WERE MADE USING A MATHEMATICAL INTERPRETATION BASED ON THE NORMAL TOTAL EMISSIVITY AND WEIGHT-TO-DENSITY RATIOS OF THE INDIVIDUAL CONSTITUENTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 845506

AD-600 370
LEXINGTON LABS INC CAMBRIDGE MASS
THERMAL RADIATION CHARACTERISTICS OF TRANSPARENT, SEMI-TRANSPARENT AND TRANSLUCENT MATERIALS UNDER NON-ISOTHERMAL CONDITIONS. (U)
DESCRIPTIVE NOTE: TECHNICAL DOCUMENTARY REPT., MAY 61-JUN 62
APR 64 125P FOLWEILER,ROBERT C. 1
CONTRACT: AF33 616 8368
PROJ: 7360
TASK: 736001 ,736004
MONITOR: TDR62 719

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*REFRACTORY MATERIALS, THERMAL RADIATION), (*TRANSPARENT PANELS, HEAT TRANSFER), ALUMINUM COMPOUNDS, OXIDES, ABSORPTION, THERMAL CONDUCTIVITY, SOLIDS, EMISSIVITY, SINGLE CRYSTALS, HIGH TEMPERATURE RESEARCH, MICROSTRUCTURE, DIFFUSION, WAVE TRANSMISSION, CRYSTAL LATTICES, SCATTERING, PERTURBATION THEORY, NUMERICAL ANALYSIS, EQUATIONS, INTEGRATION (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-286 863
CALIFORNIA UNIV BERKELEY INST OF ENGINEERING RESEARCH
THERMAL RADIATION PROPERTIES OF MATERIALS, PART II (U)
DESCRIPTIVE NOTE: FINAL REPT., SEP 60-DEC 61 ON MATERIALS ANALYSIS AND EVALUATION TECHNIQUES,
AUG 62 72P SEBAN,R.A.;
REPT. NO. TR60 370 P2
CONTRACT: AF33 616 6630
PROJ: 7360
MONITOR: ASD TR60 370 P2

UNCLASSIFIED REPORT

DESCRIPTORS: *CERAMIC COATINGS, *REFRACTORY MATERIALS, *THERMAL RADIATION, ALLOYS, BORON COMPOUNDS, CERAMIC MATERIALS, COATINGS, COPPER, HIGH-TEMPERATURE RESEARCH, IRON COMPOUNDS, MOLYBDENUM, MOLYBDENUM ALLOYS, NICKEL ALLOYS, OXIDES, PHOTOELECTRIC EFFECT, PLATINUM, PLATINUM ALLOYS, REFLECTION, RHODIUM ALLOYS, SHELTERS, STAINLESS STEEL, TEST EQUIPMENT, TEST METHODS, THERMOCOUPLES, TITANIUM COMPOUNDS, WIRE (U)
IDENTIFIERS: VOUGHT II, VOUGHT IX, RENE 41 (UNITEMP 41) (M)

RESULTS OBTAINED FOR THE SPECTRAL EMITTANCE OF MATERIALS MEASURED IN AIR AT INTERMEDIATE TEMPERATURES OF ABOUT 1400 F ARE COMPARED TO THE SPECTRAL REFLECTANCES MEASURED AT ROOM TEMPERATURE. THE TEMPERATURE EFFECT IS FOUND TO BE SMALL FOR OXIDIZED METALS AND FOR CERAMIC COATINGS AND SOME OF THE APPARENT EFFECTS ARE STILL ASSOCIATED WITH VARIATION OF THE MATERIAL AND WITH INACCURACY OF MEASUREMENT. SPECTRAL EMITTANCES FOR METALS WERE DETERMINED ONLY FOR PLATINUM. A SYSTEM DESIGNED FOR THE DETERMINATION OF THE SPECTRAL EMITTANCE OF METALS OR OF MATERIALS WITH METALLIC SUBSTRATES, IN VACUUM OR IN AN INERT ATMOSPHERE, IS DESCRIBED AND PRELIMINARY RESULTS ARE INDICATED FOR INCONEL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-270 454
CALIFORNIA UNIV BERKELEY INST OF ENGINEERING RESEARCH
THERMAL RADIATION PROPERTIES OF MATERIALS. (U)
DESCRIPTIVE NOTE: TECHNICAL REPT. FOR JUL 59-SEP 60, JUN 61 110P SEBAN ,R. A. ;ROLLING,R. E. ;
CONTRACT: AF33(616)-6630
PROJ: 7360
MONITOR: WADD TR-60-370

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON MATERIALS ANALYSIS AND EVALUATION TECHNIQUES.

DESCRIPTORS: *ALLOYS ,*HEAT-RESISTANT METALS + ALLOYS , *HEAT-RESISTANT PLASTICS ,*METALS ,*PLASTICS , *REFRACTORY COATINGS ,*REFRACTORY MATERIALS ,ABSORPTION ,ALUMINUM ALLOYS ,BORON COMPOUNDS ,CARBIDES ,CHROMATES , CHROMIUM ALLOYS ,COATINGS ,COBALT ALLOYS ,GUIDED MISSILES ,HIGH-TEMPERATURE RESEARCH ,INFRARED RADIATION ,NICKEL ALLOYS ,NIOBIUM ,PHOTOELECTRIC EFFECT , RADIOMETERS ,REFLECTION ,REFLECTOMETERS , SATELLITES(ARTIFICIAL) ,SPACECRAFT ,STEEL ,SURFACE PROPERTIES ,TEST EQUIPMENT ,TEST METHODS ,THERMAL RADIATION ,THERMOCOUPLES (M)

METHODS ARE DESCRIBED FOR MEASUREMENT OF TOTAL NORMAL EMITTANCE, IN AIR, FOR TEMPERATURES UP TO 2500 F; FOR NORMAL SPECTRAL REFLECTANCE, IN AIR, AT LOW TEMPERATURE FOR WAVELENGTHS FROM 0.30 TO 25 MICRONS; AND IN AIR, AT 1000 F FOR WAVELENGTHS FROM 1 TO 25 MICRONS. RESULTS ARE GIVEN FOR 20 SAMPLES OF DIFFERENT MATERIALS AND THE MEASURED TOTAL EMITTANCES ARE GENERALLY WITHIN 5% OF VALUES PREDICTED FROM REFLECTANCE MEASUREMENTS. REFLECTANCES WERE MEASURED AS A FUNCTION OF ANGLE FOR WAVELENGTHS OF THE ORDER OF 1 MICRON, TO GIVE ABSORPTANCES AS A FUNCTION OF ANGLE OF INCIDENCE THAT ARE USEFUL IN THE APPRAISAL OF SOLAR IRRADIATION. A SPECTRAL EMITTANCE UNIT IS DESCRIBED AND THE PRELIMINARY RESULTS FOR SAMPLES AT 1400 F SHOW GENERAL AGREEMENT WITH MEASURED VALUES OF SPECTRAL REFLECTANCE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-421 816
ARMY MATERIALS RESEARCH AGENCY WATERTOWN MASS
ANALYSIS OF A REFRACTORY COATING SYSTEM FOR THE
THERMAL PROTECTION OF TITANIUM. (U)
SEP 63 22P FARROW,RAYMOND L. ;LEVY,
MILTON ;
PROJ: 1HO 24401A111
MONITOR: AMRA TR63 13

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON MATERIALS FOR SOLID
PROPELLANT ROCKET MOTORS.

DESCRIPTORS: (*TITANIUM ALLOYS, REFRACTORY COATINGS),
(*COATINGS, TITANIUM ALLOYS), EROSION, METAL COATINGS,
CERAMIC COATINGS, FLAME SPRAYING, CYLINDRICAL BODIES,
ALUMINUM COMPOUNDS, OXIDES, NICKEL, CHROMIUM, COPPER,
PIPES, GASES, HEAT TRANSFER, ALUMINUM ALLOYS, VANADIUM
ALLOYS, TIN ALLOYS, DENSITY, THERMAL CONDUCTIVITY,
EMISSIVITY, EXPERIMENTAL DATA, HIGH-TEMPERATURE
RESEARCH, POROSITY, STEEL (U)
IDENTIFIERS: 1963 (U)

METALLIC AND CERAMIC REFRACTORY COATINGS ARE BEING
CONSIDERED TO EXTEND THE USEFUL LIFE OF TITANIUM
UNDER CONDITIONS OF HIGH TEMPERATURES AND EROSIVE
ATMOSPHERES. THE EFFECTS OF THE REFRACTORY
COMPOSITE SYSTEM OF FLAME-SPRAYED NICKEL-CHROME,
ALUMINUM OXIDE, AND COPPER, ON THE THERMAL
CHARACTERISTICS OF A TITANIUM TUBE WERE INVESTIGATED.
THE REFRACTORY COMPOSITE SYSTEM WAS EXAMINED
METALLOGRAPHICALLY FOR ADHESION OF COATING TO
COATING, AND COATING TO SUBSTRATE, POROSITY OF
COATINGS, AND EFFECT OF DEPOSITION ON THE STRUCTURE
OF THE TITANIUM SUBSTRATE. A COMPARISON OF THE
WEIGHTS OF THE COMPOSITE TITANIUM TUBE SYSTEM AND A
SIMILAR SIZE STEEL TUBE WAS MADE. A WEIGHT
REDUCTION OF 19 PERCENT IS EFFECTED BY THE USE OF THE
COATED TITANIUM SYSTEM. THE ADVANTAGES AND
DISADVANTAGES OF EACH COATING ARE DISCUSSED, AND
SUGGESTIONS FOR FUTURE WORK ARE PRESENTED.
(AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 845506

AD-274 148
BATTELLE MEMORIAL INST COLUMBUS OHIO DEFENSE METALS INFORMATION CENTER
THE EMMITANCE OF CERAMICS AND GRAPHITES (U)
MAR 62 1V WOOD,W.D.;DEEM,H.W.;LUCKS,C.F.;
REPT. NO. M148
CONTRACT: AF33 616 7747

UNCLASSIFIED REPORT

DESCRIPTORS: *CARBIDES, *CERAMIC MATERIALS, *GRAPHITE, *NITRIDES, *OXIDES, *SILICIDES, ABSORPTION, ALUMINUM COMPOUNDS, BERYLLIUM COMPOUNDS, BLACKBODY RADIATION, BORON COMPOUNDS, DATA, EMISSIVITY, HEAT TRANSFER, MAGNESIUM COMPOUNDS, MOLYBDENUM COMPOUNDS, NICKEL, SILICON COMPOUNDS, SURFACES, TABLES, TANTALUM COMPOUNDS, THERMAL RADIATION, TITANIUM COMPOUNDS, TUNGSTEN COMPOUNDS, ZIRCONIUM COMPOUNDS (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 845506

AD-294 346
BATTELLE MEMORIAL INST COLUMBUS OHIO DEFENSE METALS INFORMATION CENTER
THERMAL RADIATIVE PROPERTIES OF SELECTED MATERIALS (U)
NOV 62 1V WOOD,W.D.;DEEM,H.W.;LUCKS,C.F.;
REPT. NO. 177 V2
CONTRACT: AF33 616 7747

UNCLASSIFIED REPORT

DESCRIPTORS: *CERAMIC COATINGS, *HEAT RESISTANT MATERIALS, *PAINTS, *REFRACTORY COATINGS, *THERMAL RADIATION, ALLOYS, BORIDES, BORON, CARBIDES, DATA, METAL COATINGS, METALS, OXIDES, PHOSPHATE COATINGS, REFRACTORY MATERIALS, SILICIDES (U)

THERMAL RADIATIVE PROPERTIES OF SELECTED MATERIALS. COMPILATION. BORON. BORIDE COATINGS. CARBIDE COATINGS. ENAMELS AND PAINTS. OXIDE COATINGS. SILICIDE COATINGS. PHOSPHATE COATINGS. METALLIC COATINGS. MISCELLANEOUS COATINGS.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-433 782
BATTELLE MEMORIAL INST COLUMBUS OHIO DEFENSE METALS INFORMATION CENTER
PROPERTIES OF COATED REFRACTORY METALS. (U)
JAN 64 98P GIBEAUT,W. A. ;BARTLETT,E. S.
;
REPT. NO. 195
CONTRACT: AF33 615 1121
PROJ: 8975

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPT. NO. 195, SUPPL. TO REPT. NO. 162, AD-271 384.

DESCRIPTORS: (*REFRACTORY COATINGS, REFRACTORY METALS AND ALLOYS), (*REFRACTORY METALS AND ALLOYS, REFRACTORY COATINGS), NIOBIUM, NIOBIUM ALLOYS, MOLYBDENUM, MOLYBDENUM ALLOYS, TANTALUM, TANTALUM ALLOYS, TUNGSTEN, FOILS, HEAT-RESISTANT METALS AND ALLOYS, ALUMINUM ALLOYS, TIN ALLOYS, SILICIDES, ALUMINUM COATINGS, EMISSIVITY, FATIGUE (MECHANICS), RUPTURE, OXIDATION, LIFE EXPECTANCY, MECHANICAL PROPERTIES, TENSILE PROPERTIES (U)
IDENTIFIERS: 1964 (U)

THIS REPORT SUMMARIZES THE INFORMATION GENERATED SINCE THE MIDDLE OF 1961 ON THE CHEMICAL, PHYSICAL, AND MECHANICAL PROPERTIES OF REFRACTORY METALS THAT ARE COATED WITH OXIDATION-RESISTANT COATINGS OF ADVANCED-EXPERIMENTAL OR COMMERCIAL STATUS. IT IS A SUPPLEMENT TO DMIC REPORT 162, COATINGS FOR THE PROTECTION OF REFRACTORY METALS FROM OXIDATION, DATED NOVEMBER 24, 1961. RECENT DATA ON SPECIFIC SILICIDE- AND ALUMINIDE- TYPE COATINGS FOR COLUMBIUM, MOLYBDENUM, TANTALUM, AND TUNGSTEN AND THEIR ALLOYS REFLECT GENERAL ADVANCES IN COATING QUALITY AND PERFORMANCE, UNDERSTANDING OF THE BEHAVIOR OF COATED SYSTEMS, AND MORE COMPLETE REALIZATION OF THE PROBLEMS ASSOCIATED WITH THE USE OF COATED HARDWARE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 845506

AD-272 614
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION WASHINGTON D C
MEASUREMENTS OF TOTAL EMITTANCE OF SEVERAL REFRACTORY OXIDES, CERMETS, AND CERAMICS FOR TEMPERATURES FROM 600 DEGREES F TO 2,000 DEGREES F (U)
MAR 62 1V WADE,WILLIAM R.;SLEMP,WAYNE S.;
REPT. NO. TN D 998

UNCLASSIFIED REPORT

DESCRIPTORS: *BLACKBODY RADIATION, *CERAMIC MATERIALS, *CERMETS, *FLAME SPRAYING, *HEAT RESISTANT MATERIALS, *HEAT RESISTANT METALS + ALLOYS, *HIGH-TEMPERATURE RESEARCH, *PAINTS, *REFRACTORY MATERIALS, ALUMINUM COMPOUNDS, CARBIDES, CHROMIUM ALLOYS, CHROMIUM COMPOUNDS, HYPERSONIC CHARACTERISTICS, IRON ALLOYS, MEASUREMENT, NICKEL ALLOYS, NITRIDES, OXIDES, SILICON COMPOUNDS, SUPERSONIC PLANES, TEMPERATURE CONTROL (U)

PLANES, HYPERSONICS.) *HEAT RESISTANT PAINTS. EXPERIMENTAL MEASUREMENTS OF TOTAL EMITTANCE WERE PRESENTED FOR A VARIETY OF REFRACTORY MATERIALS BELIEVED TO HAVE POSSIBLE USE AS TEMPERATURE CONTROL SURFACES FOR HIGH SUPERSONIC AND HYPERSONIC AIRCRAFT. THE FOLLOWING MATERIALS WERE STUDIED; CHEMICALLY OXIDIZED INCONEL, CRO2 BASE PAINT, AL2O3 BASE PAINT, SIC CERAMICS, SI3N4 CERAMIC, CR/AL OXIDE CERMETS, AND FLAME-SPRAYED CERMETS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-801 274 11/3
NORTH AMERICAN AVIATION INC LOS ANGELES CALIF
THE ROLE OF EMITTANCE IN REFRACTORY METAL COATING PERFORMANCE: PART I - REVIEW AND ANALYSIS. (U)
DESCRIPTIVE NOTE: SUMMARY TECHNICAL REPT. 1 JUL 65-31 JAN 66 ON PHASE 1,
JAN 66 153P BARTSCH,K. O. ;HUEBNER,A.
;
REPT. NO. NA-66-760-PT-1
CONTRACT: AF 33(615)-3039
PROJ: AF-7312
TASK: 731201
MONITOR: AFML TR-66-55-PT-1

UNCLASSIFIED REPORT
DISTRIBUTION: NO FOREIGN WITHOUT APPROVAL OF AIR FORCE MATERIALS LAB., WRIGHT-PATTERSON AFB, OHIO 45433. ATTN: MAM.

DESCRIPTORS: (*REFRACTORY COATINGS, *EMISSIVITY), (*REFRACTORY METALS, REFRACTORY COATINGS), AEROSPACE CRAFT, ROCKET MOTORS, COOLING, SILICIDES, NIOBIUM ALLOYS, MOLYBDENUM ALLOYS, TIN, ALUMINUM COMPOUNDS, TANTALUM ALLOYS, THERMAL RADIATION, HYPERSONIC FLOW (U)
IDENTIFIERS: NIOBIUM ALLOY CB-752, MOLYBDENUM ALLOY TZM (U)

THE ROLE OF EMITTANCE WAS REVIEWED FOR THE PURPOSE OF ORIENTING THE PLANNING OF A COMPREHENSIVE PROGRAM TO PROVIDE ACCURATE AND PROPER EMITTANCE DATA FOR THERMAL CALCULATIONS NEEDED IN THE DESIGN OF ADVANCED AEROSPACE VEHICLES AND ENGINES. THE FOLLOWING WAS FOUND: COATED REFRACTORY METALS ARE USED AND ARE PLANNED FOR FUTURE USE ON REENTRY AND HYPERSONIC CRUISE VEHICLES WHICH ARE COOLED ALMOST SOLELY BY THE RADIATION OF HEAT TO SPACE. SPACE ENGINE NOZZLES AND EXTENSIONS FABRICATED OF COATED REFRACTORY METALS MAY BE COOLED TO ADVANTAGE BY RADIATION. EMITTANCE VALUES HAVE A PROFOUND EFFECT ON THE RATE OF HEAT REJECTION, AND THEREBY, ON THE METAL-COATING SYSTEM TEMPERATURE WHICH, IN TURN, CONTROLS COATING LIFE AND METAL STRENGTH. THE EMITTANCE OF A COATED REFRACTORY METAL IS A FUNCTION OF ITS ENVIRONMENT WHICH INCLUDES TEMPERATURE, TIME, PARTIAL PRESSURES OF THE ATMOSPHERIC CONSTITUENTS, AND THE FREE-STREAM VELOCITY OF THE ATMOSPHERE UNDER EXTREME TEMPERATURE CONDITIONS. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-862 279 11/3
NORTH AMERICAN ROCKWELL CORP LOS ANGELES CALIF LOS ANGELES DIV
THE ROLE OF EMITTANCE IN REFRACTORY METAL COATING PERFORMANCE. PART II. TOTAL AND SPECTRAL EMITTANCE MEASUREMENTS TO 2500 F. (U)
DESCRIPTIVE NOTE: SUMMARY TECHNICAL REPT. JUL 65-AUG 68.
APR 69 174P BARTSCH,KARL O. ;KIMBALL, LEONARD G. ;HUDGINS,WALTER P. ;GEIB,ELDEN R. ;BLOCK,S. J. ;
REPT. NO. NA-66-760-2
CONTRACT: AF 33(615)-3039
PROJ: AF-7312
TASK: 731201
MONITOR: AFML TR-66-55-PT-2

UNCLASSIFIED REPORT
DISTRIBUTION: NO FOREIGN WITHOUT APPROVAL OF DIRECTOR, AIR FORCE MATERIALS LAB., ATTN: MAM. WRIGHT-PATTERSON AFB, OHIO 45433.
SUPPLEMENTARY NOTE: SEE ALSO PART 1, AD-801 274.

DESCRIPTORS: (*REFRACTORY COATINGS, EMISSIVITY), (*REFRACTORY METAL ALLOYS, REFRACTORY COATINGS), NIOBIUM ALLOYS, MOLYBDENUM ALLOYS, TANTALUM ALLOYS, SILICIDES, METAL COATINGS, CHROMIUM, TITANIUM, SILICON, ALUMINUM, TIN, IRON, SLURRY COATING (U)
IDENTIFIERS: NIOBIUM ALLOY CB-752, MOLYBDENUM ALLOY TZM, TANTALUM ALLOY 10W (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-665 701 11/3
NORTH AMERICAN ROCKWELL CORP LOS ANGELES CALIF LOS ANGELES DIV
THE ROLE OF EMITTANCE IN REFRACTORY METAL COATING PERFORMANCE. PART III. TOTAL AND SPECTRAL EMITTANCE MEASUREMENTS ABOVE 2500 F AND CORRELATION OF EMITTANCE WITH COMPOSITION. (U)
DESCRIPTIVE NOTE: SUMMARY TECHNICAL REPT. 1 OCT 65-30 DEC 68,
NOV 69 195P BARTSCH,KARL O. ;KIMBALL, LEONARD G. ;HUDGINS,WALTER P. ;GEIB,ELDEN R. ;PAGE,P. R. ;
REPT. NO. NA-66-760-2-PT-3
CONTRACT: AF 33(615)-3039
PROJ: AF-7312
TASK: 731201
MONITOR: AFML TR-66-55-PT-3

UNCLASSIFIED REPORT
DISTRIBUTION: NO FOREIGN WITHOUT APPROVAL OF DIRECTOR, AIR FORCE MATERIALS LAB., ATTN: MAM. WRIGHT-PATTERSON AFB, OHIO 45433.
SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH PHILCO FORD CORP., NEWPORT BEACH, CALIF., AERONUTRONIC DIV. SEE ALSO PART 2, AD-862 279.

DESCRIPTORS: (*REFRACTORY COATINGS, EMISSIVITY), (*REFRACTORY METAL ALLOYS, REFRACTORY COATINGS), NIOBIUM ALLOYS, MOLYBDENUM ALLOYS, TANTALUM ALLOYS, SILICIDES, METAL COATINGS, CHROMIUM, TITANIUM, SILICON, ALUMINUM, TIN, IRON, SLURRY COATING (U)
IDENTIFIERS: NIOBIUM ALLOY CB-752, MOLYBDENUM ALLOY T2M, TANTALUM ALLOY 10W (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-442 286
AMERICAN MACHINE AND FOUNDRY CO ALEXANDRIA VA ALEXANDRIA DIV
IMPROVED RADIATOR COATINGS. PART I. (U)
DESCRIPTIVE NOTE: REPT. FOR 1 APR 63-1 APR 64,
JUN 64 82P SCHATZ,ELIHU A. ;COUNTS, CHARLES R. ,III;BURKS,TEMAN L. ;
CONTRACT: AF33 657 10764
PROJ: 7340
TASK: 734007
MONITOR: ML TDR64 146

UNCLASSIFIED REPORT
NOFORN
SUPPLEMENTARY NOTE: REPORT ON NONMETALLIC AND COMPOSITE MATERIALS.

DESCRIPTORS: (*THERMAL RADIATION, CERAMIC MATERIALS), (*CERAMIC COATINGS, EMISSIVITY), (*OXIDES, REFLECTANCE), REFLECTOMETERS, BLACKBODY RADIATION, SPECTROPHOTOMETERS, ALUMINUM COMPOUNDS, COBALT COMPOUNDS, CHROMIUM COMPOUNDS, IRON COMPOUNDS, SILICON COMPOUNDS, STRONTIUM COMPOUNDS, TITANIUM COMPOUNDS, YTTRIUM COMPOUNDS, ZIRCONIUM COMPOUNDS, CHROMATES, TITANATES, TIN COMPOUNDS, SAMARIUM COMPOUNDS, GERMANIUM COMPOUNDS, MANGANESE COMPOUNDS, PARTICLE SIZE, HIGH-TEMPERATURE RESEARCH, LOW-TEMPERATURE RESEARCH, MEASUREMENT, BORON COMPOUNDS, NITRIDES, CARBIDES, MOLYBDENUM COMPOUNDS, SILICIDES, SURFACE PROPERTIES, POWDERS, SINTERING, NICEL COMPOUNDS, MAGNESIUM COMPOUNDS, PARTICLES, CERIUM COMPOUNDS (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-468 576
AMERICAN MACHINE AND FOUNDRY CO ALEXANDRIA VA ALEXANDRIA DIV
IMPROVED RADIATOR COATINGS. PART II. (U)
DESCRIPTIVE NOTE: TECHNICAL DOCUMENTARY REPT., 1 APR 64-1 APR 65,
AUG 65 99P SCHATZ,ELIHU A. ;COUNTS, CHARLES R., III. ;ALVAREZ,GEORGE H. ; HOPPKE,MARGUERITE A. ;
CONTRACT: AF33 657 10764
PROJ: 7340
TASK: 734007
MONITOR: ML TDR-64-146-PT-2

UNCLASSIFIED REPORT
NOFORN
SUPPLEMENTARY NOTE: SEE ALSO PART 1, AD 442 286.

DESCRIPTORS: (*THERMAL RADIATION, METALS), (*OXIDES, THERMAL PROPERTIES), EMISSIVITY, REFLECTION, COATINGS, THERMAL PROPERTIES, SPECTRA(VISIBLE + ULTRAVIOLET), SPECTRA(INFRARED), SINTERING, CHROMIUM COMPOUNDS, IRON COMPOUNDS, COBALT COMPOUNDS, NICKEL COMPOUNDS, ACCEPTABILITY, INSTRUMENTATION, VACUUM APPARATUS, PRESSURE, POWDERS, ALUMINUM, TUNGSTEN, TANTALUM, CHROMIUM, TEMPERATURE, MOLYBDENUM COMPOUNDS, MAGNESIUM COMPOUNDS, BONDING, PHOSPHATES, SILICATES, STAINLESS STEEL, AGING(MATERIALS) (U)
IDENTIFIERS: SPECTRAL EMITTANCE, SPECTRAL REFLECTANCE, CHROMIUM (III) OXIDE, IRON (III) OXIDE, COBALT OXIDE, NICKEL OXIDE, MOLYBDENUM TRIOXIDE, MAGNESIUM OXIDE, TIN (IV) OXIDE, ZINC OXIDE, ALUMINUM OXIDE (U)

DURING THIS SECOND YEAR'S EFFORT RESEARCH WAS CONTINUED TO UNDERSTAND THE FUNDAMENTAL VARIABLES CONTROLLING THE THERMAL RADIATION PROPERTIES OF MATERIALS, AND TO APPLY THE RESULTS TOWARD THE DEVELOPMENT OF HIGH EMITTANCE COATINGS FOR THE 600 TO 1000 C RANGE. STUDIES THAT WERE PERFORMED INCLUDED A SURVEY OF THE SPECTRAL EMITTANCE OF 42 SINTERED OXIDES, A COMPARISON OF TOTAL EMITTANCE MEASUREMENTS PERFORMED IN VACUUM WITH THOSE PERFORMED AT ATMOSPHERIC PRESSURE, AND THE EFFECT OF NUMEROUS VARIABLES ON THE SPECTRAL REFLECTANCE OF COMPACTED POWDERS. FOR THE LATTER CASE THE EFFECTS OF PRESSURE, PARTICLE SIZE, COMPOSITION, AND EXTENT OF HEATING WERE DETERMINED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-423 743
AMERICAN MACHINE AND FOUNDRY CO ALEXANDRIA VA ALEXANDRIA DIV
HIGH TEMPERATURE, HIGH EMITTANCE INTERMETALLIC COATINGS. PART I. EMITTANCE AND REFLECTANCE OF INTERMETALLIC COMPOUNDS (U)
DESCRIPTIVE NOTE: FINAL REPT. FOR JUN 62-JUN 63,
AUG 63 181P SCHATZ,ELIHU A. ;GOLDBERG, DAVID M. ;PEARSON,ERVIN G.;BURKS,TEMAN L. ;

CONTRACT: AF33 657 8877
PROJ: 7340
TASK: 734007
MONITOR: ASD TDR63 657, PT. I

UNCLASSIFIED REPORT
NOFORN
SUPPLEMENTARY NOTE:

DESCRIPTORS: (*INTERMETALLIC COMPOUNDS, COATINGS), (*EMISSIVITY, INTERMETALLIC COMPOUNDS), REFLECTION, BORIDES, SILICIDES, HIGH TEMPERATURE RESEARCH, PHYSICAL PROPERTIES, SPECTRA (VISIBLE + ULTRAVIOLET), SPECTRA (INFRARED), CARBIDES, NITRIDES, ALUMINUM COMPOUNDS, BORON COMPOUNDS, BERYLLIUM COMPOUNDS, SILICON COMPOUN(U)
IDENTIFIERS: 1963, PACK CEMENTATION, BERYLLIDES, ALUMINIDES, CHROMIDES (U)

SPECTRAL TOTAL REFLECTANCE (0.23 - 2.65 MICRONS) AND SPECTRAL NORMAL EMITTANCE CURVES ARE PRESENTED FOR HIGH TEMPERATURE, OXIDATION - RESISTANT, INTERMETALLIC COMPOUNDS. MAJOR EMPHASIS WAS GIVEN TO SINTERED SAMPLES OF ALUMINIDES, BORIDES, BERYLLIDES AND SILICIDES. ALUMINIDE AND SILICIDE COATINGS PREPARED BY PACK CEMENTATION TECHNIQUES WERE ALSO STUDIED. THE EMITTANCE AND REFLECTANCE PROPERTIES ARE SIMILAR FOR MOST COMPOUNDS HAVING DIFFERENT STOICHIOMETRIC RATIOS OF THE SAME ELEMENTS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-468 059
AMERICAN MACHINE AND FOUNDRY CO ALEXANDRIA VA ALEXANDRIA DIV
HIGH TEMPERATURE, HIGH EMITTANCE INTERMETALLIC COATINGS. PART III. PREPARATION AND THERMAL RADIATION PROPERTIES OF INTERMETALLIC COMPOUNDS AND COATINGS. (U)
DESCRIPTIVE NOTE: FINAL REPT., JUN 64-MAY 65,
JUL 65 100P SCHATZ,ELIHU A. ;ALVAREZ, GEORGE H. ;COUNTS,CHARLES R. ,;;;HOPPKE, MARGUERITE A. ;
CONTRACT: AF33 657 8877
PROJ: 7340
TASK: 734007
MONITOR: ML TR-65-217

UNCLASSIFIED REPORT
NOFORN
SUPPLEMENTARY NOTE: REPORT ON NONMETALLIC AND COMPOSITE MATERIALS. SEE ALSO PART I, AD-423 743.

DESCRIPTORS: (*COATINGS, OXIDES), (*EMISSIVITY), INTERMETALLIC COMPOUNDS, TITANIUM ALLOYS, REFLECTION, THERMAL RADIATION, SURFACE PROPERTIES, POWDERS, ALUMINUM ALLOYS, BORIDES, SILICIDES, OXIDATION, BERYLLIUM ALLOYS, HEATING, X-RAY DIFFRACTION ANALYSIS, TANTALUM ALLOYS, THICKNESS, LOW-PRESSURE RESEARCH, METAL FILMS, NIOBIUM ALLOYS, HIGH-TEMPERATURE RESEARCH, BARIUM COMPOUNDS, CHLORIDES, FLUORIDES (U)
IDENTIFIERS: *BINARY SYSTEMS, *SURFACE ROUGHNESS, *HI-VAC, INERT ATMOSPHERE, *THIN OXIDE FILM, *OXIDATION-RESISTANT COATINGS (U)

SURFACE ROUGHNESS AND SURFACE OXIDATION WERE FOUND TO BE THE TWO KEY VARIABLES THAT MODIFIED THE THERMAL RADIATION PROPERTIES OF INTERMETALLIC COMPOUNDS AND COATINGS. INCREASES IN SURFACE ROUGHNESS OR IN THE THICKNESS OF THE OXIDE LAYERS USUALLY INCREASED THE EMITTANCE OF THE SPECIMENS. THE THICKNESSES OF THE FORMED OXIDE LAYERS WERE FOUND TO BE ESPECIALLY DIFFICULT TO CONTROL BECAUSE EVEN UNDER HIGH VACUUM (0.00001 TOR) OR IN INERT ATMOSPHERE (MORE THAN 1 PPM OXYGEN) SUFFICIENT OXYGEN WAS PRESENT TO REACT WITH INTERMETALLIC COMPOUNDS WHEN HEATED TO OVER 500 C. THIN OXIDE LAYERS ACTED AS INTERFERENCE FILMS, AND THEIR EFFECT WAS DEPENDENT ON THICKNESS, AND THE REFRACTIVE INDICES OF THE OXIDES AND INTERMETALLICS. ALUMINIDE, BERYLLIDE AND SILICIDE COATINGS, PREPARED BY A PACK-CEMENTATION METHOD, WERE INVESTIGATED. HIGH EMITTANCE COATINGS, HAVING EXCELLENT OXIDATION RESISTANCE, WER(U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-462 018
BOEING CO SEATTLE WASH
EVALUATION OF TIC EMITTANCE IMPROVEMENT TOPCOAT ON DISIL COATED TZM (MO-0.5TI-0.1ZR), (U)
OCT 64 78P GUNDERSON,J. W. ;LINDH,D. V. ;STRATTON,W. K.;
REPT. NO. D2-36145-1
CONTRACT: AF33 615 1624

UNCLASSIFIED REPORT
NOFORN
SUPPLEMENTARY NOTE:

DESCRIPTORS: (*REFRACTORY COATINGS, EMISSIVITY), (*REENTRY VEHICLES, REFRACTORY COATINGS), COATINGS, SILICON COMPOUNDS, SILICONE PLASTICS, AERODYNAMIC HEATING, MOLYBDENUM ALLOYS, TITANIUM COMPOUNDS, CARBIDES, ADHESION, MECHANICAL PROPERTIES, WEATHERPROOFING, HIGH TEMPERATURE RESEARCH, VIBRATION, OXIDATION, SPACE ENVIRONMENTAL CONDITIONS, SIMULATION, TESTS, MANNED SPACECRAFT (U)
IDENTIFIERS: MOLYBDENUM ALLOY TZM, X-20 SPACECRAFT (U)

EVALUATION OF THE ADHESION, WEATHERING RESISTANCE AND ALLOWABLE TOTAL NORMAL EMITTANCE FOR THE TIC TOPCOAT ON DISIL COATED TZM WAS REQUIRED TO CHARACTERIZE THE SYSTEM'S PERFORMANCE POTENTIAL FOR AEROSPACE APPLICATIONS SUCH AS PASSIVELY COOLED GLIDE ENTRY. SPECIMENS OF 20 MIL SHEET TZM WERE COATED AND EVALUATED. THE TIC TOPCOAT RESULTED IN TOTAL NORMAL EMITTANCE HIGHER THAN THOSE OBTAINED FOR STRAIGHT DISIL COATING ON TZM. THERE WAS NO LOSS OF ADHESION IN BEND TESTING IN SPITE OF SEVERE CRACKING OF THE DISIL COATING AND EVEN BASE METAL FRACTURE. LIKEWISE THERE WAS NO LOSS OF ADHESION IN VIBRATION TESTING. WEATHERING EXPOSURES PRODUCED NO DETECTABLE EFFECTS ON EMITTANCE OR OXIDATION LIFE IN SUBSEQUENT SIMULATED GLIDE ENTRY PROFILE TESTS. ISOTHERMAL-ISOBARIC TESTING VERIFIED THAT THE EMITTANCE OF THE COATING SYSTEM WAS STABLE FOR EXTENDED EXPOSURE TIMES IN AERO-SPACE TYPE ENVIRONMENTS, AT TEMPERATURES UP TO 3000 F. ALLOWABLE TOTAL NORMAL EMITTANCE VALUES WERE CALCULATED FOR A SPECIFIC TYPICAL ENTRY FLIGHT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-347 895 11/6 11/2 22/2
BOEING CO SEATTLE WASH
PERFORMANCE OF OXIDATION RESISTANT COATINGS FOR COLUMBIUM ALLOYS (U)
DEC 63 1V DREISBACH,W. GLEN
REPT. NO. D2 81111 2

SCP 4 CONFIDENTIAL REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (NIOBIUM ALLOYS, PROTECTIVE TREATMENTS), (*COATINGS, PERFORMANCE (ENGINEERING)), BOOST-GLIDE VEHICLES, MANNED SPACECRAFT, RESEARCH PLANES, OXIDATION, SILICIDES, CERAMIC COATINGS, REFRACTORY COATINGS, PRESSURE, TIME, TEMPERATURE, EMISSIVITY, THICKNESS, TITANIUM ALLOYS, ZIRCONIUM ALLOYS (U)
IDENTIFIERS: 1963, X-20 SPACECRAFT, D-36 NIOBIUM ALLOYS (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-423 179
NAVAL RADIOLOGICAL DEFENSE LAB SAN FRANCISCO CALIF
TOTAL HEMISPHERICAL EMITTANCE AND NORMAL SPECTRAL EMITTANCE (LAMBDA = 0.65 MICRON) OF OXIDATION PROTECTIVE COATINGS. (U)
DESCRIPTIVE NOTE: REPT. FOR 27 FEB-19 DEC 62, 29P ALVARES,N. J. ;
PROJ: TASK
TASK: 736001
MONITOR: ASD TDR63 269

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON THE CHEMISTRY AND PHYSICS OF MATERIALS.

DESCRIPTORS: (*REFRACTORY METALS AND ALLOYS, COATINGS), (*COATINGS, EMISSIVITY), (*PROTECTIVE TREATMENTS, REFRACTORY METALS AND ALLOYS), ANTIOXIDANTS, THERMAL RADIATION, SILICIDES, PYROMETERS, OPTICAL EQUIPMENT, MOLYBDENUM, TUNGSTEN, NIOBIUM, TANTALUM (U)
IDENTIFIERS: 1963, PACK CEMENTATION (U)

MEASUREMENTS OF THE VARIATION OF TOTAL HEMISPHERICAL EMITTANCE AND NORMAL SPECTRAL EMITTANCE (LAMBDA = 0.65 MICRON) WITH INCREASING TEMPERATURES HAVE BEEN MADE ON SOME PACK-CEMENTATION DISILICIDE TYPE OXIDATION RESISTANT COATINGS FOR THE REFRACTORY METALS, MOLYBDENUM, TUNGSTEN, NIOBIUM AND TANTALUM. THE NORMAL SPECTRAL EMITTANCE (LAMBDA = 0.65 MICRON) OF THE COATINGS ON DISC SAMPLES, WAS DETERMINED WITH A MICRO-OPTICAL PYROMETER, WHICH WAS SIGHTED INTO A BLACK BODY HOLE, DRILLED IN THE SAMPLE AND THEN ONTO THE ADJACENT AREA. THE TOTAL HEMISPHERICAL EMITTANCE OF THE COATINGS ON RIBBON SPECIMENS WAS FOUND BY USE OF A CALIBRATED TOTAL RADIATION PYROMETER, WHICH SAMPLED THE ENERGY RADIATED FROM A UNIFORM TEMPERATURE REGION ESTABLISHED ABOUT THE CENTER PORTION OF THE ELECTRICALLY HEATED RIBBON SPECIMEN. THE DIFFUSENESS OF THE SURFACE OF THE VARIOUS COATINGS WAS FOUND BY TAKING ANGULAR DISTRIBUTIONS OF THE RADIATION EMITTED FROM THE CENTER PORTION OF THE SAMPLE RIBBONS AT VARIOUS TEMPERATURES WITH THE TOTAL RADIATION PYROMETER. THE CONFIDENCE LIMITS PLACED ON THESE DATA ARE = 15 PERCENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-299 388
MARQUARDT CORP VAN NUYS CALIF
STABILITY AND EMITTANCE OF MOLYBDENUM DISILICIDE COATING UNDER VARYING TEMPERATURES AND PRESSURES (U)
MAR 63 1V RABENSTEINE,A.S.;
REPT. NO. PR 281 3Q 4
CONTRACT: AF33 657 8706

UNCLASSIFIED REPORT

DESCRIPTORS: *EMISSIVITY, *LOW-PRESSURE RESEARCH, *SILICIDES, COATINGS, CORROSION INHIBITION, EVAPORATION, HIGH-TEMPERATURE RESEARCH, MOLYBDENUM, MOLYBDENUM ALLOYS, RODS, SHEETS, STABILITY, TITANIUM ALLOYS (U)

STABILITY AND EMITTANCE OF MOLYBDENUM DISILICIDE COATING UNDER VARYING TEMPERATURES AND PRESSURES.

A70-13752# ISSUE 3 PAGE 512 CATEGORY 17 69
/10/00 UNCLASSIFIED DOCUMENT
Emissivity and electrical resistivity of titanium carbide at high temperatures
(Titanium carbide hemispherical and spectral emissivity and electrical resistivity measured at high temperature)
A/CHEKHOVSKOI, V. IA.; B/PETROV, V. A.; C/SHEINDLIN, A. E. (AC/AKADEMIIA NAUK SSSR, NAUCHNO-ISSLEDOVATEL'SKII INSTITUT VYSOKIKH TEMPERATUR, MOSCOW, USSR/.)
AKADEMIIA NAUK SSSR, IZVESTIIA, NEORGANICHESKIE MATERIALY, VOL. 5, P. 1533- 1536. IN RUSSIAN.
/*ELECTRICAL RESISTIVITY/*EMISSIVITY/*HIGH TEMPERATURE TESTS/*TITANIUM CARBIDES/ SINTERING/ SPECTRAL EMISSION/ WAVELENGTHS

A69-30985# ISSUE 15 PAGE 2640 CATEGORY 17
69/04/00 UNCLASSIFIED DOCUMENT

Integral hemispherical emissivity of pyrolytic zirconium carbide

(Pyrolytic zirconium carbide emissivity during initial heating compared with results for specimens prepared by powder metallurgy)

A/CHEKHOVSKOI, V. IA.; B/DYMOV, B. K.; C/KILIN, V. S.; D/PETROV, V. A.

TEPLOFIZIKA VYSOKIKH TEMPERATUR, VOL. 7, P. 260-264. /AKADEMIIA NAUK SSSR, NAUCHNO- ISSLEDOVATEL'SKII INSTITUT VYSOKIKH TEMPERATUR, MOSCOW, USSR/. IN RUSSIAN.

/*HIGH TEMPERATURE RESEARCH/*PYROLYTIC MATERIALS/*THERMAL EMISSION/*ZIRCONIUM CARBIDES/ POWDER METALLURGY/ REFRACTORY MATERIALS/ THERMODYNAMIC PROPERTIES

A69-30984# ISSUE 15 PAGE 2640 CATEGORY 17
69/04/00 UNCLASSIFIED DOCUMENT

Integral normal emissivity of tantalum and hafnium carbides at temperatures ranging from 1300 to 3000 deg K

(Integral normal emissivity of Ta and Hf carbides at temperatures from 1300 to 3000 K measured by radiation method in vacuum)

A/NIKOLAEVA, V. A.; B/PETROV, V. A.; C/SHEINDLIN, A. E.; D/VINNIKOVA, A. N. (AA/AKADEMIIA NAUK SSSR, NAUCHNO- ISSLEDOVATEL'SKII INSTITUT VYSOKIKH TEMPERATUR, MOSCOW, USSR/.)

TEPLOFIZIKA VYSOKIKH TEMPERATUR, VOL. 7, P. 257-259. IN RUSSIAN.

/*EMISSIVITY/*HAFNIUM CARBIDES/*HIGH TEMPERATURE TESTS/*TANTALUM CARBIDES/*THERMAL EMISSION/ THERMOPHYSICAL PROPERTIES/ VACUUM CHAMBERS

A67-29546 ISSUE 15 PAGE 2503 CATEGORY 17 6
7/00/00 UNCLASSIFIED DOCUMENT
High temperature emittance of coated refractory metal.
(Coated refractory metals thermal emittance measured at high temperatures for design of reentry vehicle under time-temperature-pressure profile)
A/ALLEN, T. H.; B/JOHNSON, C. R.; C/RUSERT, E. L. (AC/MCDONNELL CO., ST. LOUIS, MO./.)
IN- THE EFFECTS OF THE SPACE ENVIRONMENT ON MATERIALS, SOCIETY OF AEROSPACE MATERIAL AND PROCESS ENGINEERS, NATIONAL SYMPOSIUM AND EXHIBIT, 11TH, ST. LOUIS, MO., APR. 19-21, 1967, PROCEEDINGS. <A67-29534 15-18< NORTH HOLLYWOOD, CALIF., WESTERN PERIODICALS CO. /SCIENCE OF ADVANCED MATERIALS AND PROCESS ENGINEERING SERIES. VOLUME 11/, 1967, P. 111- 123. 42 REFS.
/*HEAT SHIELD/*RADIATION MEASUREMENT/*REENTRY VEHICLE/*REFRACTORY METAL/*THERMAL EMISSION/ CONFERENCE/ EMISSION/ HEAT/ MATERIAL/ MEASUREMENT/ METAL/ PRESSURE/ RADIATION/ REENTRY/ REFRACTORY/ SHIELD/ TESTING/ THERMAL/ TIME/ VEHICLE

A63-24987* ISSUE 24 CATEGORY 6 63/00/00 UNCLASSIFIED DOCUMENT
(Emittance measurements of materials suitable for spacecraft radiator coatings)
A/ASKWYTH, W. H.; B/HAYES, R. J.; C/MIKK, G.
EMITTANCE OF MATERIALS SUITABLE FOR USE AS SPACECRAFT RADIATOR COATINGS. W. H. ASKWYTH, R. J. HAYES, AND G. MIKK /UNITED AIRCRAFT CORP., PRATT AND WHITNEY AIRCRAFT DIV., EAST HARTFORD, CONN./. /AMERICAN ROCKET SOCIETY, SPACE POWER SYSTEMS CONFERENCE, SANTA MONICA, CALIF., SEPT. 25-28, 1962./
IN- POWER SYSTEMS FOR SPACE FLIGHT. PROGRESS IN ASTRONAUTICS AND AERONAUTICS. VOL. 11. EDITED BY MORRIS ZIPKIN AND RUSSELL N. EDWARDS. NEW YORK, ACADEMIC PRESS, INC., 1963, P. 401-425. NASA-SUPPORTED RESEARCH.
/*COATING/*SPACECRAFT RADIATOR/ EMISSIVITY/ HEAT/ HEMISPHERE/ HIGH VACUUM/ MATERIAL/ MEASUREMENT/ RADIATION/ RADIATOR/ SPACECRAFT/ THERMAL

N69-70383 RG1FPD571 62/03/15 UNCLASSIFIED DO
CUMENT
Emittance coating studies on Cb-1 Zr alloy
A/DOTSON, L. E.
GENERAL ELECTRIC CO., EVENDALE, OHIO.

/*METAL COATINGS/*NIOBIUM ALLOYS/*NUCLEAR POWE
R PLANTS/*THERMAL STABILITY/*ZIRCONIUM ALLOYS/ ALU
MINUM OXIDES/ HEAT RADIATORS/ HEAT RESISTANT ALLOY
S/ SPACECRAFT POWER SUPPLIES/ TEST EQUIPMENT/ THER
MAL EMISSION/ TITANIUM OXIDES

N63-82157 61/07/00 UNCLASSIFIED DOCUMENT
A/HJELM, L. N.
DIRECTORATE OF MATERIALS AND PROCESSES, AERONAU
TICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO.
DIRECTORATE OF MATERIALS AND PROCESSES, AERO
NAUTICAL SYSTEMS DIV., WRIGHT-PATTERSON AFB, OHIO
REFRACTORY EMISSIVE COATINGS L. N. HJELM IN ITS M
ATER. SYMP., HOTEL WESTWARD HO, PHOENIX, ARIZ., 13
-15 SEPT. 1961 JULY 1961 P482-502 10 REFS /SEE
N63- 82126 -30/
/ CERAMICS/ COATING/ DIFFUSION/ EMISSIVITY/ GR
APHITE/ METAL/ REFRACTION/ REINFORCEMENT/ SPRAYING

N64-17588*# ISSUE 9 CATEGORY 19 NASA-CR-5323
4 AMF-AR63-502A 63/00/00 UNCLASSIFIED DOCUMENT

Supplemental information on high temperature co
ating and material programs at amf
(High temperature and high emittance coatings)
A/BROWNING, M. E.; B/MC CANDLESS, L. C.; C/PE
ARSON, E. G.; D/SCHATZ, E. A.
AMERICAN MACHINE AND FOUNDRY CO., ALEXANDRIA, V
A. AVAIL. CFSTI
<1964< 6 P SUPPL. THE REPT. TO THE NASA-AS
D REFRACTORY COMPOSITES WORKING GROUP, PALO ALTO,
CALIF., 11-14 MAR. 1963
/*COATING/*HIGH TEMPERATURE RESEARCH/ ALUMINUM
/ BERYLLIUM/ COMPOUND/ EMISSIVITY/ HIGH TEMPERATUR
E/ OXIDATION/ RESEARCH/ RESISTANCE/ SILICIDE

N64-17216# ISSUE 9 CATEGORY 18 64/01/24 UNCLASSIFIED DOCUMENT

Oxidation-resistant coatings for refractory metals review of recent developments

(Oxidation-resistant coatings for refractory metals and alloys)

A/ENGLISH, J. J.; B/GIBEAUT, W. A.

BATTELLE MEMORIAL INST., COLUMBUS, OHIO. (DEFENSE METALS INFORMATION CENTER)

24 JAN. 1964 4 P REFS

/*OXIDATION RESISTANCE/*PROTECTIVE COATING/*REFRACTORY ALLOY/*REFRACTORY METAL/ ALLOY/ COATING/ EMISSIVITY/ METAL/ MOLYBDENUM/ NIOBIUM/ OXIDATION/ PROTECTION/ REFRACTORY/ RESISTANCE/ SILICIDE/ TANTALUM/ TUNGSTEN

N64-11593# ISSUE 3 CATEGORY 18 LAMS-2965 W-7405-ENG-36 63/09/01 UNCLASSIFIED DOCUMENT

Total optical emissivity and electrical resistivity of /u sub 0.3 zr sub 0.7/c in the temperature range 1400 deg k to 2800 deg k

(Optical emissivity & electrical resistivity of uranium-zirconium carbide pin at high temperatures)

A/MILLER, L. W.; B/TATRO, L. D.

LOS ALAMOS SCIENTIFIC LAB., N. MEX. AVAIL. CFSTI

19 NOV. 1963 17 P

/*ELECTRIC RESISTANCE/*OPTICAL EMISSION/*URANIUM COMPOUND/*ZIRCONIUM CARBIDE/ CARBIDE/ COMPOUND/ COMPRESSION/ ELECTRIC/ EMISSIVITY/ HIGH TEMPERATURE/ OPTICAL/ OPTICS/ PIN/ POWDER/ RESISTIVITY/ URANIUM/ ZIRCONIUM

N62-10783*# ISSUE 3 CATEGORY 21 PWA-1877 N
ASW-104 60/00/00 UNCLASSIFIED DOCUMENT
(Determination of the emissivity of materials)
PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, CONN
.

PRATT & WHITNEY AIRCRAFT, EAST HARTFORD, CON
N. PROGRESS REPORT ON THE DETERMINATION OF THE EMI
SSIVITY OF MATERIALS DURING THE PERIOD FROM JULY 1
, 1960, THROUGH SEPT. 30, 1960. <1960< 73 P. REF
S. /PWA-1877/ /NASA CONTRACT NASW-104/ OTS- PH $
7.60, MI $2.39

/*CARBIDE/*EMISSION/*OXIDE/*PHOSPHATE/ ALUMINU
M/ BINDER/ BLACK/ BLAST/ BODY/ BORON/ CRYSTAL/ CRY
STALLOGRAPHY/ EMISSIVITY/ ENDURANCE/ HOLE/ INTENSI
TY/ IRON/ MEASUREMENT/ PLATINUM/ QUALITY/ RADIATIO
N/ RIG/ SAND/ SCANNING/ SIZE/ SPECTRUM/ SURFACE/ T
ITANIUM/ VARIATION

N63-18320# ISSUE 17 CATEGORY 17 NASA-CR-5048
7 PWA-2163 NASW-104 63/00/00 UNCLASSIFIED DO
CUMENT
(Emission spectrum measurements of refractory c
oating materials)
A/HAYES, R. J.
PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, CONN
.

PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, C
ONN. DETERMINATION OF THE EMISSIVITY OF MATERIALS
QUARTERLY PROGRESS REPORT, OCT. 1 THROUGH DEC. 31
, 1962 R. J. HAYES 1963 96P /NASA CONTRACT NASW-
104/ /NASA CR-50487, RWA-2163/ OTS- $8.60 PH, $3
.08 MF

/*COATING/*EMISSION SPECTRUM/*REFRACTORY MATER
IAL/ ALUMINUM/ BLACK/ BONDING/ BORON/ CALCIUM/ CAR
BIDE/ CHROMIUM/ COBALT/ DIOXIDE/ EMISSION/ EMISSIV
ITY/ ENDURANCE/ MATERIAL/ NICKEL/ OXIDE/ PALLADIUM
/ REFRACTORY/ SILICON/ SPECTRUM/ STANNIC/ STRONTIU
M/ TIN/ TITANATE/ TITANIUM

N63-10264* ISSUE 1 CATEGORY 6 ARS PAPER-2538
-62 62/00/00 UNCLASSIFIED DOCUMENT
(Emittance of materials suitable for use as spa
cecraft radiator coatings)
A/ASKWYTH, W. H.; B/HAYES, R. J.; C/MIKK, G.
PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, CONN
.

PRATT AND WHITNEY AIRCRAFT, EAST HARTFORD, C
ONN. THE EMITTANCE OF MATERIALS SUITABLE FOR USE A
S SPACECRAFT RADIATOR COATINGS W. H. ASKWYTH, R. J
. HAYES, AND G. MIKK N.Y., AM. ROCKET SOC. <1962<
26 P 5 REFS PRESENTED AT THE ARS SPACE POWER S
YSTEMS CONF., SANTA MONICA, CALIF., SEPT. 25-28, 1
962 /SPONSORED BY NASA/ /ARS PAPER-2538-62/ ARS-
$0.50 MEMBERS, $1.00 NONMEMBERS

/*COATING/*EMISSION/*SPACE RADIATOR/ ACETYLENE
/ ALUMINUM/ ARC/ BONDING/ BORON/ CARBIDE/ CHROMIUM
/ DETERIORATION/ EMISSIVITY/ HEMISPHERE/ HIGH VACU
UM/ IRON/ MATERIAL/ METAL/ NICKEL/ OXIDE/ PHOSPHAT
E/ PLASMA/ POWER/ RADIATOR/ SILICON/ SPACE/ SPACEC
RAFT/ SUBSTRATE/ SUITABILITY/ TEMPERATURE/ TITANIU
M/ VACUUM

N62-13757*# ISSUE 11 CATEGORY 21 NASA-TN-D-1
268 62/07/00 UNCLASSIFIED DOCUMENT
(Total normal emittance of boron nitride from 1
200-deg f to 1900-deg f with normal spectral emitt
ance data at 1400-deg f)
A/CASEY, F. W., JR.; B/WALKER, G. H.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION.
LANGLEY RESEARCH CENTER, LANGLEY STATION, VA.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATIO
N. LANGLEY RESEARCH CENTER, LANGLEY STATION, VA. M
EASUREMENT OF TOTAL NORMAL EMITTANCE OF BORON NITR
IDE FROM 1,200 DEG F TO 1,900 DEG F WITH NORMAL SP
ECTRAL EMITTANCE DATA AT 1,400 DEG F. GILBERT H. W
ALKER AND FRANCIS W. CASEY, JR. WASHINGTON, NASA,
JULY 1962. 22 P. 2 REFS. /NASA TN D-1268/ OTS-
$0.75.

/*BORON NITRIDE/*EMISSION/*SPECTRUM/ AERODYNAM
ICS/ BORON/ CAVITY/ EDGE/ EMISSIVITY/ FLUX/ HIGH S
PEED/ HIGH TEMPERATURE/ INFRARED/ INSERTION/ LINEA
R/ MEASUREMENT/ NITRIDE/ NONCONDUCTOR/ NORMAL/ NOZ
ZLE/ RADIATION/ REENTRY/ REFRACTORY/ ROCKET/ SPECI
MEN/ SPEED/ SURFACE/ TECHNIQUE/ TEMPERATURE/ THICK
NESS/ TOTAL/ TRANSPARENCY

GROUP 3

Concerning the high temperature emittance characteristics of carbon, graphites, ablative materials and chars.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-438 220
AVCO CORP WILMINGTON MASS RESEARCH AND ADVANCED DEVELOPMENT DIV
THE INFRARED EMISSION SPECTRA OF PLASTICS ABLATING IN A LOW ENTHALPY AIR STREAM: MEASUREMENTS OF SURFACE TEMPERATURES AND TEMPERATURE PROFILES BEHIND THE SURFACES, (U)
FEB 60 19P HANST,P. L. I
REPT. NO. 7TM60 11
CONTRACT: AF04 647 258

UNCLASSIFIED REPORT
NOFORN
SUPPLEMENTARY NOTE: REPORT ON WS-133A.

DESCRIPTORS: (*ABLATION, PLASTICS), (*PLASTICS, SPECTRA (INFRARED)), AIR, ENTHALPY, SURFACE TEMPERATURE, TEMPERATURE, EMISSIVITY, INFRARED RADIATION, POLYETHYLENE PLASTICS, ACRYLIC RESINS, EPOXY PLASTICS, TESTS, GUIDED MISSILES (SURFACE-TO-SURFACE), REENTRY VEHICLES, NOSE CONES, SURFACE PROPERTIES, HEAT TRANSFER (U)
IDENTIFIERS: TEFLON, MINUTEMAN (U)

THE INFRARED EMISSION SPECTRA OF ABLATING SAMPLES OF PLASTICS HAVE BEEN RECORDED AND ANALYZED TO OBTAIN SURFACE TEMPERATURES AND APPROXIMATE TEMPERATURE PROFILES BEHIND THE SURFACES. POLYETHYLENE, POLYTETRAFLUOROETHYLENE (TEFLON), POLYMETHYLMETHACRYLATE, AND AN EPOXY RESIN WERE STUDIED UNDER ABLATIVE CONDITIONS IN AN ELECTRICALLY HEATED AIR STREAM. A METHOD IS DEVELOPED FOR CALCULATING FROM THE EMISSION INTENSITIES THE ACTUAL SURFACE TEMPERATURE AND THE TEMPERATURE PROFILE BEHIND THE ABLATING SURFACE. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-449 240
AVCO CORP WILMINGTON MASS RESEARCH AND ADVANCED DEVELOPMENT DIV
RESEARCH ON THE CHARACTERIZATION AND ANALYSIS OF NEW PLASTIC AND COMPOSITE MATERIALS IN ADVANCED RE-ENTRY ENVIRONMENTS. (U)
DESCRIPTIVE NOTE: TEST REPT. NO. 1,
SEP 64 25P HOERCHER,H. E. !RECESSO,J. !
REPT. NO. SR 61 122
CONTRACT: AF33 616 7938

UNCLASSIFIED REPORT
NOFORN
SUPPLEMENTARY NOTE:

DESCRIPTORS: (*COMPOSITE MATERIALS, THERMAL PROPERTIES), ATMOSPHERE ENTRY, SIMULATION, TEMPERATURE, MEASUREMENT, TEXTILES, GRAPHITE, QUARTZ, ABLATION, ADDITIVES, SURFACE TEMPERATURES, ELECTRIC ARCS, PLASMA PHYSICS, PLASMA JETS, EMISSIVITY (U)

SIX MATERIAL SPLASH TESTS WERE PERFORMED IN A 250 KW MODEL 500 ARC ON SIX EXPERIMENTAL MATERIAL COMPOSITES. THREE COMPOSITES WERE GRAPHITE CLOTH REINFORCED CARBONACEOUS SUBSTRATES WITH ORGANIC AND INORGANIC ABLATION FILLERS, AND THE OTHER THREE WERE QUARTZ CLOTH REINFORCED CARBONACEOUS SUBSTRATES WITH ORGANIC AND INORGANIC ABLATIVE FILLERS. A TABLE SHOWS THE PLASMA GENERATOR CHARACTERISTICS AS WELL AS MEASURED ABLATION VELOCITY, SURFACE TEMPERATURE, TOTAL SURFACE RADIATION, AND ASSUMED EMISSIVITY FOR EACH OF THE SAMPLES TESTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-638 619L 11/5 11/4 20/6 22/2
11/2

AVCO EVERETT RESEARCH LAB EVERETT MASS
SPECTRAL EMISSIVITY MEASUREMENTS OF ABLATING PHENOLIC
GRAPHITE. (U)

DESCRIPTIVE NOTE: RESEARCH REPT.,
JUL 68 30P CHANG,JOHN H. ;SUTTON,
GEORGE W. ;

REPT. NO. AERL-RR-295

CONTRACT: DA-01-021-AMC-12005(Z), ARPA ORDER-525

UNCLASSIFIED REPORT

DISTRIBUTION: DOD ONLY; OTHERS TO ADVANCED
RESEARCH PROJECTS AGENCY, ATTN: TIO.
WASHINGTON, D. C. 20301.

DESCRIPTORS: (*GRAPHITE, PHENOLIC PLASTICS),
(*FIRE RESISTANT TEXTILES, LAMINATES),
(*LAMINATES, EMISSIVITY), (*GRAPHITED MATERIALS,
ABLATION), PYROLYTIC GRAPHITE, HEAT-RESISTANT
MATERIALS, SPECTRA(VISIBLE + ULTRAVIOLET), ARC
HEATERS, SUBSONIC FLOW, SURFACE PROPERTIES,
SPECTRA(INFRARED), BLACKBODY RADIATION,
INFRARED RADIATION, LIGHT, SURFACE TEMPERATURES,
HEAT SHIELDS, ATMOSPHERE ENTRY, BOUNDARY LAYER,
OPTICAL INSTRUMENTS, COMPOSITE MATERIALS (U)

IDENTIFIERS: *ABLATIVE MATERIALS, *PHENOLIC
GRAPHITE, *SPECTRAL EMISSIVITY, EMISSION SPECTRUM,
GREYBODY RADIATION (U)

THE SURFACE SPECTRAL RADIANCE OF ABLATING PHENOLIC GRAPHITE WAS MEASURED IN THE WAVELENGTH REGION BETWEEN 0.3 AND 10.5 MICRONS. THE MATERIAL WAS HEATED TO ITS ABLATION TEMPERATURE IN AN ARC-HEATED SUBSONIC AIR STREAM HAVING AN EQUILIBRIUM TEMPERATURE OF APPROXIMATELY 5000 K. THE MAGNITUDE AND THE SLOPE OF MEASURED SURFACE SPECTRAL RADIANCE VS WAVELENGTH CURVE IN THE VISIBLE AND NEAR INFRARED SPECTRUM INDICATE THE SURFACE TEMPERATURE TO BE 2500 K + OR - 100 K. BY COMPARING THE MEASURED SURFACE SPECTRAL RADIANCE WITH THAT CALCULATED FROM PLANCK RADIATION LAW FOR A 2500 K BLACKBODY THE SPECTRAL EMISSIVITY VARIES FROM 0.87 IN THE VISIBLE SPECTRUM TO 0.62 IN THE INFRARED. THE SPECTRAL EMISSIVITY DATA SHOW THAT THE ABLATING PHENOLIC GRAPHITE RADIATES NEARLY AS A GREYBODY IN THE VISIBLE AND IN THE WAVELENGTH REGION OF 3 TO 10.5 MICRONS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-478 597L 20/13
MARTIN CO ORLANDO FLA
INFRARED SIGNATURE CHARACTERISTICS. (U)
DESCRIPTIVE NOTE: FINAL REPT. 30 MAR-30 NOV 65,
JAN 66 174P DURAND ,JAMES L. HOUSTON,
C. KENNETH I
REPT. NO. OR-6820
CONTRACT: AF 08(635)-5087
PROJ: AF-7849
TASK: 784903
MONITOR: ATL TR-66-8

UNCLASSIFIED REPORT
DISTRIBUTION: USGO: OTHERS TO DIRECTORATE OF ARMAMENT DEVELOPMENT, EGLIN AFB, FLA. ATTN: ATTR.

DESCRIPTORS: (*PYROLYTIC GRAPHITE, INFRARED RADIATION), (*BORON COMPOUNDS, INFRARED RADIATION), SPECTRA(INFRARED), EMISSIVITY, NITRIDES, REFLECTION, HIGH-TEMPERATURE RESEARCH, MEASUREMENT, DATA, REVIEWS, TABLES, OXIDES, INTERMETALLIC COMPOUNDS, ALLOYS, BORIDES, SILICIDES, BERYLLIUM ALLOYS, ALUMINUM ALLOYS, NICKEL ALLOYS, CERAMIC COATINGS, CERAMIC MATERIALS, METALS, BIBLIOGRAPHIES (U)
IDENTIFIERS: INFRARED SIGNATURES, BORON NITRIDE, INCONEL (ALLOYS) (U)

EMITTANCE MEASUREMENTS WERE MADE FROM 2.5 TO 15 MICRONS BY HEATING TEST SPECIMENS OF PYROLYTIC GRAPHITE AND PYROLYTIC BORON NITRIDE BY AN INDUCTION-CONDUCTION TECHNIQUE IN VACUUM. ROOM REFLECTANCE MEASUREMENTS WERE MADE FROM 0.259 TO 25 MICRONS, AND VALUES OF TOTAL NORMAL EMITTANCE WERE COMPUTED AT SEVERAL TEMPERATURES. IT WAS FOUND THAT THE SPECTRAL EMITTANCES OF THE PYROLYTIC MATERIALS WERE QUITE SIMILAR TO DATA OBTAINED FOR THEIR POLYCRYSTALLINE COUNTERPARTS. EMITTANCE OF PYROLYTIC GRAPHITE NORMAL TO THE BASAL PLANES DECREASED WITH INCREASING WAVELENGTH BEYOND 2.5 MICRONS AND IS NOT A STRONG FUNCTION OF TEMPERATURE. POLISHED PYROLYTIC GRAPHITE SURFACES GAVE HIGHER EMITTANCES THAN UNPOLISHED SURFACES; THIS PHENOMENA IS RELATED TO THE CRYSTALLOGRAPHIC ORIENTATION. IT IS CONCLUDED THAT PYROLYTIC GRAPHITE IS METAL-LIKE IN THAT THE EMITTANCE QUALITATIVELY AGREES WITH DRUDE'S RELATION. EMITTANCE OF PYROLYTIC BORON NITRIDE WAS FOUND TO BE GREATER THAN ABOUT 0.8 OVER THE REGION FROM 2.5 TO 15 MICRONS WITH THE EXCEPTION OF A DEEP MINIMUM AT ABOUT 7 MICRONS. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-462 006
UNION CARBIDE CORP PARMA OHIO
RESEARCH ON HIGH TEMPERATURE PROTECTIVE COATINGS FOR GRAPHITE. (U)
DESCRIPTIVE NOTE: PROGRESS REPT. NO. 4, 1 JUN-31 AUG 64,
SEP 64 78P EPREMIAN,E. (CRISCIONE,J. M.
;
CONTRACT: AF33 657 11253

UNCLASSIFIED REPORT
RELEASE OR ANNOUNCEMENT TO FOREIGN GOVERNMENTSOR THEIR NATIONALS IS NOT AUTHORIZED.
SUPPLEMENTARY NOTE:

DESCRIPTORS: (*GRAPHITE, PROTECTIVE TREATMENTS), (*REFRACTORY COATINGS, GRAPHITE), (*METAL COATINGS, INDIUM), OXIDATION, EMISSIVITY, OXYGEN, DIFFUSION, BERYLLIUM COMPOUNDS, ZIRCONIUM COMPOUNDS, HAFNIUM COMPOUNDS, OXIDES, THORIUM COMPOUNDS, HIGH-TEMPERATURE RESEARCH, ELECTRODEPOSITION, VAPOR PLATING, TENSILE PROPERTIES, COMPATIBILITY, PERMEABILITY, REACTION KINETICS, REDUCTION (CHEMISTRY), CHEMICAL REACTIONS, METALLOGRAPHY, FILMS, VAPORIZATION (U)

THE CURRENT PHASE OF THE PROGRAM WAS DEVOTED TO INVESTIGATING THE OXIDATION AND EMISSIVITY OF IRIDIUM, THE DIFFUSION OF OXYGEN THROUGH ZIRCONIA AND BERYLLIA, THE MECHANICAL COMPATIBILITY OF IRIDIUM WITH GRAPHITE, AND THE CHEMICAL KINETICS OF THE CARBOTHERMIC REDUCTION OF ZIRCONIA, HAFNIA, AND THORIA. THE EMISSIVITY OF IRIDIUM DETERMINED IN AIR WAS FOUND TO DECREASE FROM 0.58 AT 1040 C TO 0.50 AT 1600 C. THE EMISSIVITY IN PURE ARGON WAS ESSENTIALLY CONSTANT AT 0.3 TO TEMPERATURES OF 1760 C AND WAS FOUND TO DECREASE FROM 0.56 AT 960 C TO 0.43 AT 1850 C IN AN OXYGEN-HELIUM MIXTURE. IR2O3 IS INDICATED AS A VOLATILE OXIDE SPECIES OF IRIDIUM AT 1150 TO 1200 C. METHODS OF DEPOSITING IRIDIUM ON GRAPHITE HAVE BEEN INVESTIGATED. THESE INCLUDE ELECTRODEPOSITION, SLURRY DIPPING AND VAPOR DEPOSITION. THE TENSILE STRENGTH OF ELECTRODEPOSITED IRIDIUM WAS FOUND TO BE 24,600 LBS/SQ/IN WHICH COMPARES REASONABLY WELL WITH THE VALUE OF 26,700 LBS/SQ/IN FOR WROUGHT IRIDIUM. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-459 521
SOUTHERN RESEARCH INST BIRMINGHAM ALA
DETERMINATION OF THE EMITTANCE OF A CHAR CAKE. (U)
DESCRIPTIVE NOTE: FINAL REPT.,
AUG 62 16P ENGELKE,WILFRED T. !PEARS,
C. D. !
REPT. NO. 5465-1419-1

UNCLASSIFIED REPORT
NOFORN
SUPPLEMENTARY NOTE: SUBCONTRACT TO HERCULES POWDER CO., CONTRACT NORD16640.

DESCRIPTORS: (*GRAPHITE, EMISSIVITY), (*EMISSIVITY, GRAPHITE), MEASUREMENT, THERMAL PROPERTIES, REFRACTORY MATERIALS, CARBON, THERMAL RADIATION, LABORATORY EQUIPMENT, THERMOCOUPLES, RADIOMETERS, HIGH-TEMPERATURE RESEARCH (U)
IDENTIFIERS: CHAR CAKE (U)

THE EMITTANCE OF A CHAR CAKE WAS DETERMINED FROM 500 TO 3600 F. THE VALUES RANGED FROM 0.92 AT 500 F TO 0.97 AT 3600 F. SOME DIFFICULTIES WERE ENCOUNTERED DURING THE PROGRAM. THE MATERIAL COMPLETELY DISAPPEARED, APPARENTLY FROM VAPORIZATION, IN THE TEMPERATURE RANGE OF 3300 TO 3700 F. THEREFORE, EMITTANCE VALUES TO 5000 F, AS ORIGINALLY PROPOSED, WERE NOT OBTAINED. ALSO, MORE DATA SCATTER THAN USUAL WAS OBTAINED DUE TO DIFFICULTIES OF OBTAINING AN EVEN SURFACE TEMPERATURE OVER THE SPECIMEN. THE TEMPERATURE VARIED BY AS MUCH AS 200 F. APPARENTLY, THE MATERIAL HAD A LOW THERMAL CONDUCTIVITY AND A VARIABLE STRUCTURE SO THAT TEMPERATURE GRADIENTS LARGER THAN NORMAL FOR GRAPHITES WERE DEVELOPED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-426 665
IIT RESEARCH INST CHICAGO ILL
RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME XXI. CARBON ARC IMAGE FURNACE STUDIES OF GRAPHITE, (U)
NOV 63 49P NULL,M.R.;LOZIER,W.W.;
CONTRACT: AF33 616 6915
PROJ: 7350;
TASK: TASKS 735002;,738102
MONITOR: WADD TR61 72. VOL. 21

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON REFRACTORY INORGANIC NON-METALLIC MATERIALS.

DESCRIPTORS: (*CARBON, REFLECTION), (*GRA PHITE, REFLECTION), EMISSIVITY, HIGH-TEMPERA TURE RESEARCH, PYROLYTIC GRAPHITE, HEATING, COOLING, POLARIZATION, LABORATORY FURNACES, SURFACE TEMPERATURE, PHYSICAL BROPERTIES, THERMAL CONDUCTIVITY, SURFACE PROPERTIES, IMAGES, SUBLIMATION, OXIDATION, MATHEMATICAL ANALYSIS. (U)
IDENTIFIERS: CARBON ARC IMAGE FURNACE, SPEC TRAL REFLECTANCE, 1963. (U)

MEASUREMENTS OBTAINED USING A CARBON ARC IMAGE FURNACE INDICATE THAT THE SPECTRAL REFLECTANCE AND EMISSIVITY OF CARBON AND GRAPHITE SAMPLES IN THE VISIBLE REGION OF THE SPECTRUM ARE STRONG LY DEPENDENT ON SURFACE FINISH, BUT ARE INDEPEN DENT OF TEMPERATURE TO AT LEAST 3000 K, REGARD LESS OF SURFACE FINISH. DESCREPANCIES WITH OTHER MEASUREMENTS OF EMISSIVITY ARE INDICATED TO BE CAUSED BY ERRORS IN THE MEASUREMENT OF SURFACE TEMPERATURE, DUE TO THERMAL GRADIENTS. INFOR MATION HAS BEEN OBTAINED WITH THE CARBON ARC IMAGE FURNACE INDICATING THAT THE THERMAL CON DUCTIVITY OF SURFACE MATEEPENDS STRONGLY ON SURFACE FINISH AND IS SMALLER THAN THE CON DUCTIVITY OF SUBSTRATE MATERIAL. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-297 946
GENERAL ELECTRIC CO CINCINNATI OHIO
CARBONIZATION OF PLASTICS AND REFRACTORY MATERIALS RESEARCH (U)
JAN 63 1V COFFMAN,J.A.;KIBLER,G.M.;
CONTRACT: AF33 616 6841
MONITOR: ASD TR60 646 P2

UNCLASSIFIED REPORT

DESCRIPTORS: *AROMATIC COMPOUNDS, *PLASTICS, *REFRACTORY MATERIALS, ABSORPTION SPECTRUM, CARBIDES, CARBON, EMISSIVITY, EPOXY PLASTICS, GRAPHITE, HAFNIUM COMPOUNDS, MEASUREMENT, MOLYBDENUM, PHENOLIC PLASTICS, POLYMERS, PYROLYSIS, SPECTROSCOPY, TANTALUM, TITANIUM COMPOUNDS(U)

CARBONIZATION OF PLASTICS; THE VAPOR PRESSURE OF REFRACTORY MATERIALS; AND THE SPECTRAL EMISSIVITY OF REFRACTORIES.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 845506

AD-276 966
WATER POLLUTION RESEARCH BOARD WATFORD (ENGLAND)
THE SPECTRAL EMISSIVITY AND TOTAL NORMAL EMISSIVITY OF COMMERCIAL GRAPHITES AT ELEVATED TEMPERATURES (U)
MAY 62 1V GRENIS,ALBERT F.;LEVITT,ALBERT P.;
REPT. NO. TR851 2 1

UNCLASSIFIED REPORT

DESCRIPTORS: *GRAPHITE, ATOMIC SPECTROSCOPY, BLACKBODY RADIATION, DETERMINATION, ELECTROMAGNETIC WAVES, EMISSIVITY, GUIDED MISSILES, HIGH-TEMPERATURE RESEARCH, MEASUREMENT, NUCLEAR POWER PLANTS, OPTICAL INSTRUMENTS, PYROLYSIS, PYROMETERS, RADIATION MEASUREMENT SYSTEMS COMPONENTS, ROCKET PROPULSION, STRUCTURES, SURFACE PROPERTIES, SURFACES, TEMPERATURE, THERMAL RADIATION (U)

THE SPECTRAL EMISSIVITIES, AT AN EFFECTIVE WAVELENGTH OF 0.65 MICRONS, AND TOTAL NORMAL EMISSIVITIES, WERE DETERMINED FOR MACHINED AND POLISHED SURFACES OF THE GRAPHITES GREAT LAKES CARBON H1LM AND H3LM, AND SPEER 7100. THE SPECTRAL EMISSIVITIES WERE INVESTIGATED WITHIN 1000 TO 3000 C. FOR MACHINED SURFACES, THE SPECTRAL EMISSIVITY DECREASED WITH INCREASING TEMPERATURE FROM 0.87 TO 0.81 FOR H1LM; FROM 0.87 TO 0.83 FOR H3LM; AND FROM 0.87 TO 0.78 FOR SPEER. FOR POLISHED SURFACES, THE SPECTRAL EMISSIVITY REMAINED CONSTANT WITH INCREASING TEMPERATURE AND THE MEAN VALUE WAS 0.855 FOR H1LM; 0.777 FOR H3LM; AND 0.820 FOR SPEER 7100. THE TOTAL NORMAL EMISSIVITIES WERE INVESTIGATED FROM 1600 TO 3000 C. FOR MACHINED SURFACES, THE MEAN VALUE OF THE TOTAL NORMAL EMISSIVITY WAS 0.852 FOR H1LM; 0.852 FOR H3LM; AND 0.847 FOR SPEER 7100. FOR POLISHED SURFACES, THE MEAN VALUE OF THE TOTAL NORMAL EMISSIVITY WAS 0.802 FOR H1LM; 0.808 FOR H3LM; AND 0.800 FOR SPEER 7100. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-660 892 11/2 20/13
AEROSPACE CORP EL SEGUNDO CALIF LAB OPERATIONS
BASAL PLANE EMITTANCE OF PYROLYTIC GRAPHITE AT ELEVATED TEMPERATURES, (U)
JUL 67 46P CHAMPETIER,ROBERT J. I
REPT. NO. TR-0158(3250-20)-10
CONTRACT: F04695-67-C-0158
MONITOR: SAMSO TR-67-5

UNCLASSIFIED REPORT

DESCRIPTORS: (*PYROLYTIC GRAPHITE, EMISSIVITY), THERMAL PROPERTIES, TEMPERATURE, RESISTANCE(ELECTRICAL), THERMAL CONDUCTIVITY (U)

A DIRECT MEASUREMENT OF THE TOTAL HEMISPHERICAL EMITTANCE OF 'AS DEPOSITED' PG LAYERS ON ATJ GRAPHITE CYLINDERS IN THE RANGE FROM 1200 TO 2840C IS DESCRIBED. THE METHOD CONSISTED OF RESISTIVELY HEATING THESE LONG, THIN CYLINDERS INSIDE A COOLED, BLACKENED ENCLOSURE UNTIL THE POWER GENERATED WAS ALL RADIATED AND TEMPERATURE EQUILIBRIUM ENSUED. BY SIGHTING AN OPTICAL PYROMETER THROUGH A WINDOW IN THE ENCLOSURE, THE APPARENT TEMPERATURE OF THE SURFACE AND THE TRUE TEMPERATURE OF A CAVITY INSIDE THE SAMPLES COULD BE MEASURED. THESE TEMPERATURES, AS WELL AS THE ELECTRICAL POWER SUPPLIED TO THE SAMPLE, WERE RECORDED FOR EACH EQUILIBRIUM TEMPERATURE. THESE DATA FOR VARIOUS SAMPLE THICKNESSES WERE USED TO DETERMINE THE TRUE TEMPERATURE OF THE SURFACE, THE TOTAL HEMISPHERICAL EMITTANCE, EPSILON-H, AND THE NORMAL EMITTANCE AT 0.65 MICRONS. THE ELECTRICAL RESISTIVITY IN THE AB-PLANE AND THE THERMAL CONDUCTIVITY IN THE C-DIRECTION WERE ALSO DETERMINED. THE EPSILON-H FOR PG WAS APPROXIMATELY 0.6 MICRONS FROM 1300 TO 2600C. EXPOSURE FOR A FEW SECONDS IN AN INERT ATMOSPHERE OR IN A VACUUM TO TEMPERATURES ABOVE 2600C, IRREVERSIBLY ALTERED THE SURFACE FINISH AND INCREASED EPSILON-H TO PROGRESSIVELY HIGHER VALUES DEPENDING ON THE TIME AND TEMPERATURE. THE NORMAL EMITTANCE VALUES AT 0.65 MICRONS ALSO WERE SIGNIFICANTLY AFFECTED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-489 597 8/7 20/13
MICHIGAN UNIV ANN ARBOR INST OF SCIENCE AND TECHNOLOGY
A HIGH-TEMPERATURE BLACKBODY RADIATION SOURCE. SUPPLEMENT I: SPECTRAL EMISSIVITY OF GRAPHITE, (U)
AUG 66 19P YAMADA,H. Y. ;
REPT. NO. 4613-131-T
CONTRACT: SD-91

UNCLASSIFIED REPORT
DISTRIBUTION: NO FOREIGN WITHOUT APPROVAL OF ADVANCED RESEARCH PROJECTS AGENCY, WASHINGTON, D. C. 20321.
SUPPLEMENTARY NOTE: SUPPLEMENT 1 TO REPT. NO. 4613-86-T DATED JUN 65, AD-616 758.

DESCRIPTORS: (*BLACKBODY RADIATION, *GRAPHITE), EMISSIVITY, SPECTRA(VISIBLE + ULTRAVIOLET), PYROLYTIC GRAPHITE, HIGH-TEMPERATURE RESEARCH, SPECTRA(INFRARED), RADIATORS, HIGH-TEMPERATURE RESEARCH (U)

THE SPECTRAL EMISSIVITY OF GRAPHITE WAS FOUND TO BE ESSENTIALLY INDEPENDENT OF TEMPERATURE AT LAMBDA = 0.65 MICRONS IN THE RANGE 1000 TO 2000 C AND TO BE BOTH WAVELENGTH AND TEMPERATURE DEPENDENT IN THE WAVELENGTH REGION 0.65 < LAMBDA = OR < 5.5 MICRONS AND TEMPERATURE RANGE 1000 TO 1600 C. THE CONCLUSION DRAWN IS THAT GRAPHITE CAVITY RADIATORS WHICH ARE EVALUATED TO BE GOOD BLACKBODY APPROXIMATIONS IN THE VISIBLE WILL BE AS GOOD OR BETTER IN THE INFRARED. (AUTHOR) (U)

X70-70037 AD-838619L RR-295 DA-01-021-AMC-1200
5 ARPA ORDER 525 68/07/00 UNCLASSIFIED DOCUMEN
T NASA ONLY
Spectral emissivity measurements of ablating ph
enolic graphite
A/CHANG, J. H.; B/SUTTON, G. W.
AVCO-EVERETT RESEARCH LAB., EVERETT, MASS.

/*ABLATION/*EMISSIVITY/*GRAPHITE/*OPTICAL MEAS
UREMENT/*SPECTRAL REFLECTANCE/ COOLING/ GRAPHS (CH
ARTS)/ MATHEMATICAL MODELS

A70-15590*# ISSUE 4 PAGE 787 CATEGORY 33 6
9/11/00 UNCLASSIFIED DOCUMENT
Spectral and integrated emittance of ablation c
hars and carbon
(Ablation chars, carbon and graphite spectral e
mittance and reflectance as function of wavelength
and temperature, noting applications to atmospher
ic entry heat shielding)
A/SPITZER, C. R.; B/WILSON, R. G. (AA/NASA,
LANGLEY RESEARCH CENTER, HAMPTON, VA./.)
AIAA JOURNAL, VOL. 7, P. 2140-2142.
/*ABLATIVE MATERIALS/*CARBON/*CHARRING/*SPECTR
AL EMISSION/*SPECTRAL REFLECTANCE/ EMITTANCE/ GRAP
HITE/ REENTRY SHIELDING/ TEMPERATURE EFFECTS/ WAVE
LENGTHS

GROUP 4

Concerning the emittance and absorptance of high temperature gases encountered during atmospheric reentrys.

A69-31892*# ISSUE 16 PAGE 2877 CATEGORY 33
NGL-01-002-001 69/04/00 UNCLASSIFIED DOCUMENT

Radiative heat flux for an optically thin gas.
(Approximate expression for temperature dependent radiative heat flux in optically thin gas, considering reentry body hypersonic flight)
A/WU, S. T. (AA/ALABAMA, U., HUNTSVILLE, ALA./.)
AIAA JOURNAL, VOL. 7, P. 727, 728.
/*GAS DENSITY/*OPTICAL THICKNESS/*RADIATIVE HEAT TRANSFER/*TEMPERATURE EFFECTS/ DENSITY DISTRIBUTION/ HYPERSONIC FLIGHT/ REENTRY VEHICLES/ TEMPERATURE DISTRIBUTION/ THERMODYNAMIC EQUILIBRIUM

A69-25233# ISSUE 11 PAGE 2002 CATEGORY 33
69/02/00 UNCLASSIFIED DOCUMENT
Problems associated with radiant heat transfer in hypersonic aerodynamics
(Radiant heat transfer in hypersonic aerodynamic heating, discussing radiant flux and carbon dioxide concentration in reentry problems)
A/KONKOV, A. A.; B/NEILAND, V. IA.; C/NIKOLAEV, V. M.; D/PLASTININ, IU. A.
TEPLOFIZIKA VYSOKIKH TEMPERATUR, VOL. 7, P. 140-164. IN RUSSIAN.
/*AERODYNAMIC HEATING/*HYPERSONIC REENTRY/*RADIATIVE HEAT TRANSFER/*REENTRY VEHICLES/ CARBON DIOXIDE CONCENTRATION/ CONVECTIVE HEAT TRANSFER/ FLUX DENSITY/ HYPERSONIC FLIGHT/ MARS ATMOSPHERE/ STAGNATION POINT

N63-18510* ISSUE 17 CATEGORY 7 63/00/00 UNCLASSIFIED DOCUMENT
(Spectral emittance of carbon dioxide at high temperature)
A/OPPENHEIM, U. P.
ISRAEL INST. OF TECH., HAIFA.
ISRAEL INST. OF TECH., HAIFA SPECTRAL EMISSIVITY OF THE 4.3 MU CO SUB 2 BAND AT 1200 DEG K U. P. OPPENHEIM IN NINTH SYMP. /INTERN./ ON COMBUST., CORNELL U., ITHACA, N.Y., AUG. 27 - SEPT. 1, 1962 1963 P 96-101 20 REFS /SEE N63-18501 17-26/
/*CARBON DIOXIDE/*HIGH TEMPERATURE RESEARCH/*SPECTRAL EMISSION/ EMISSIVITY/ GAS/ HIGH TEMPERATURE/ INFRARED/ PRESSURE/ RADIATION/ SPECTRUM

N63-15321*# ISSUE 12 CATEGORY 29 ARF-A200-4
NASR-65/00/ 63/03/00 UNCLASSIFIED DOCUMENT

(Radiative energy transfer on entry into mars a nd venus - emissivity of carbon dioxide at high te mperature)

A/DAVIS, W. O.

IIT RESEARCH INST., CHICAGO, ILL.

ARMOUR RESEARCH FOUNDATION, CHICAGO, ILL. RA DIATIVE ENERGY TRANSFER ON ENTRY INTO MARS AND VEN USQUARTERLY REPORT NO. 4 WILLIAM O. DAVIS MAR. 196 3 38P 16 REFS /NASA CONTRACT NASR-65/00// /ARF-A 200-4/ OTS- $3.60 PH, $1.34 MF

/*CARBON DIOXIDE/*EMISSION/*ENERGY TRANSFER/*H IGH TEMPERATURE/*MARS /PLANET//*RADIATIVE HEAT TRA NSFER/*VENUS/ ABSORPTION/ CONCENTRATION/ EMISSIVIT Y/ ENERGY/ GAS/ HEAT TRANSFER/ MARS/ MEASUREMENT/ MOLECULE/ PLANET/ PRESSURE/ RADIATION/ SHOCK/ TEST / TRANSFER/ WAVE

N62-11838# ISSUE 6 CATEGORY 11 AFOSR-1901
AF 49/638/-984 62/02/06 UNCLASSIFIED DOCUMENT

(Radiative transfer and opacity of heated gases)

A/PATCH, R. W.; B/PENNER, S. S.

CALIFORNIA INST. OF TECH., PASADENA. (GUGGENH EIM JET PROPULSION CENTER)

GUGGENHEIM JET PROPULSION CENTER, CALIF. INS T. OF TECH., PASADENA. RADIATIVE TRANSFER STUDIES AND OPACITY CALCULATIONS FOR HEATED GASES. TECHNIC AL REPORT 6. S. S. PENNER AND R. W. PATCH. JAN. 1 962. 45 P. 28 REFS. /AFOSR-1901/ /CONTRACT AF 4 9/638/-984/

/*GAS/*GAS SPECTROSCOPY/*HEATING/*PLASMA/*RADI ATION TRANSFER/*SPECTROSCOPY/ ABSORPTION/ ATOM/ AT OMIZER/ COEFFICIENT/ COMPUTATION/ CONE/ CONSERVATI ON/ CONVECTION/ EMISSION/ EMISSIVITY/ EQUATION/ EX CHANGER/ HEAT/ HEAT TRANSFER/ HIGH TEMPERATURE/ IO N/ ISOLATOR/ LAYER/ MOMENT/ NOSE/ PLANCK EQUATION/ RADIATION/ RAYON/ REENTRY/ ROSSELAND ABSORPTION C OEFFICIENT/ SHOCK/ SILENCE/ SPACECRAFT/ SPECTRUM/ TEMPERATURE/ THERMODYNAMICS/ TRANSFER/ TRANSOSONDE PROJECT/ TRANSPARENCY/ VEHICLE

X64-12200*# ISSUE 6 CATEGORY 1 NASA-CR-55494
NASW-748 64/01/00 UNCLASSIFIED DOCUMENT G
OVT. AGCY. ONLY

Research in the physics of high speed re-entry quarterly progress report, 31 dec. 1963

(Reentry physics - heat transfer, radiation in carbon dioxide mixtures, shock front temperature measurements, and magnetohydrodynamics)

AVCO-EVERETT RESEARCH LAB., EVERETT, MASS.

JAN. 1964 11 P

/*MAGNETOHYDRODYNAMICS/*RADIATIVE HEAT TRANSFER/*REENTRY PHYSICS/*SHOCK FRONT/ CONVECTION/ FRONT / HEAT/ MEASUREMENT/ PHYSICS/ RADIATION/ REENTRY/ SHOCK/ TEMPERATURE/ TRANSFER

GROUP 5

Concerning measurement methods for high temperature and material emittance determinations.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-864 774 14/2 20/13
DUNN ASSOCIATES INC SILVER SPRING MD*
FEASIBILITY OF THERMAL RADIATIVE PROPERTY MEASUREMENTS UNDER SIMULATED REENTRY CONDITIONS. (U)
DESCRIPTIVE NOTE: FINAL REPT.,
JUN 69 83P KNEISSL,GERHART J. IKAY, RICHARD B. ;
CONTRACT: F33615-68-C-1420
PROJ: AF-7381
TASK: 738102
MONITOR: AFML TR-69-238

UNCLASSIFIED REPORT
DISTRIBUTION: NO FOREIGN WITHOUT APPROVAL OF DIRECTOR, AIR FORCE MATERIALS LAB., ATTN: MAAM. WRIGHT-PATTERSON AFB, OHIO 45433.

DESCRIPTORS: (*ATMOSPHERE ENTRY, SIMULATION), (*HEAT SHIELDS, THERMAL RADIATION), (*THERMAL RADIATION, MEASUREMENT), SIMULATION, PLASMA SHEATH, STAGNATION POINT, ENTHALPY, EMISSIVITY, MATHEMATICAL ANALYSIS, FEASIBILITY STUDIES (U)

THE FEASIBILITY OF PERFORMING THERMAL RADIATIVE PROPERTY MEASUREMENTS UNDER SIMULATED REENTRY CONDITIONS IS INVESTIGATED. IT IS ASSUMED THAT AN ACCEPTABLE SIMULATION WOULD BE A PLASMA WHICH PROVIDED ESSENTIALLY THE SAME STAGNATION POINT ENTHALPY AND PRESSURE AS ACTUALLY ENCOUNTERED DURING REENTRY. BASED ON TYPICAL MEDIUM L/D AND TYPICAL HIGH L/D FLIGHT PROFILES THE RADIATIVE CHARACTERISTICS OF THE PLASMA AND THE HEATED REENTRY SURFACE ARE ESTIMATED. THEN THE THEORETICAL POSSIBILITIES ARE EXPLORED TO OBTAIN THE TOTAL HEMISPHERICAL EMITTANCE. A LITERATURE SURVEY IS UNDERTAKEN TO FIND MEASUREMENT TECHNIQUES FOR HIGH TEMPERATURE THERMAL RADIATIVE PROPERTIES. FINALLY, AN EXPERIMENTAL PROCEDURE IS DESCRIBED TO DETERMINE THE TOTAL HEMISPHERICAL EMITTANCE. THE MAIN SOURCE OF ERRORS, THE UNCERTAINTY IN THE SURFACE TEMPERATURE MEASUREMENT IS DISCUSSED. WAYS TO MINIMIZE THIS PROBLEM ARE ALSO GIVEN. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-354 429 16/3
WINZEN RESEARCH INC SOUTH ST PAUL MINN
THE COMPUTATION OF SURFACE TEMPERATURE OF A RE-ENTRY VEHICLE FROM OBSERVED SPECTRAL INTENSITIES (U)
DESCRIPTIVE NOTE: INTERIM REPT., 1 OCT 63-30 SEP 64,
OCT 64 84P LISTON,DARRELL H. ;LOTZE,
HERBERT R. ;
REPT. NO. TR64 4
PROJ: 627A

SCP 4 CONFIDENTIAL REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*REENTRY VEHICLES, SURFACE TEMPERATURES), THERMAL RADIATION, INTENSITY, ABLATION, EMISSIVITY, CYLINDRICAL BODIES, CONICAL BODIES, SPHERES, PROGRAMMING (COMPUTERS), ITERATIVE METHODS, LEAST SQUARE METHOD, MEASUREMENT (U)

SOME PHYSICAL ASPECTS INVOLVED WITH THE SURFACE RADIATION OF A REENTRY VEHICLE ARE REVIEWED AND APPLIED TO SET UP THE FORMULAS FOR DETERMINING THE TEMPERATURE FROM OBSERVED SPECTRAL INTENSITIES. THE MISSILE GEOMETRY IS ASSUMED TO BE KNOWN FROM SPECIFICATIONS FOR THE REENTRY EXPERIMENTS AND IS USED TO FORMULATE THE ASPECT ANGLE EFFECT FOR DIFFERENT BODY SHAPES AND TO INTERPRET THE OBSERVED INTENSITIES QUANTITATIVELY. IN THIS RESPECT THE APPROACH IS DIFFERENT FROM KNOWN TECHNIQUES WHICH ARE USEFUL FOR DISCRIMINATING VARIOUS RADIATOR TYPES AND WHICH WERE BASED ON THE CONCEPT OF THE EFFECTIVE GRAY BODY TEMPERATURE AND OF THE EFFECTIVE EMISSIVITY-AREA PRODUCT. WITH THE ADDITIONAL INFORMATION OF BODY DIMENSION, ABLATION TEMPERATURE AND EMISSIVITY FUNCTION, IT IS POSSIBLE UNDER CERTAIN CONDITIONS TO RECOVER FROM OBSERVED RADIATION DATA THE ACTUAL TEMPERATURE AS A FUNCTION OF SURFACE DISTANCE. A STRAIGHT LINE PROFILE SEEMS TO BE AN ADEQUATE APPROXIMATION IN PRACTICAL CASES. THE FEASIBILITY OF METHODS IS STUDIED WHICH CAN BE USED FOR THE EVALUATION OF 2, 3 OR N OBSERVED INTENSITIES. ACTUAL COMPUTER PROGRAMS APPLYING THESE METHODS ARE DISCUSSED AND IT IS INVESTIGATED HOW ERRORS IN THE INPUT DATA PROPAGATE INTO THE COMPUTED VALUES OF TEMPERATURE AND TEMPERATURE GRADIENT. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-273 665
AERONAUTICAL SYSTEMS DIV WRIGHT-PATTERSON AFB OHIO
LABORATORY TECHNIQUES FOR STUDYING THERMALLY ABLATIVE PLASTICS (U)
1V SCHWARTZ,HERBERT S.1

UNCLASSIFIED REPORT
NOFORN

DESCRIPTORS: *ABLATION, *ASBESTOS, *GLASS TEXTILES, *PHENOLIC PLASTICS, *PLASTICS, *SILICONE PLASTICS, BLACKBODY RADIATION, DECOMPOSITION, EMISSIVITY, GUIDED MISSILES, LAMINATES, MATERIALS, MECHANICAL PROPERTIES, PYROLYSIS, REENTRY VEHICLES, ROCKET MOTOR NOZZLES, ROCKET MOTORS, TEST METHODS, THERMAL DIFFUSION, THERMAL INSULATION, THERMAL RADIATION (U)

THE UTILIZATION OF PLASTIC ABLATIVE-INSULATIVE MATERIALS IN RE-ENTRY AND PROPULSION ENVIRONMENTS AND THE FACTORS GOVERNING THEIR PERFORMANCE ARE BRIEFLY DESCRIBED. THE PERTINENT MATERIAL RESPONSE CHARACTERISTICS ARE SEPARATED INTO 3 MAJOR CATEGORIES: THERMAL, CHEMICAL, AND PHYSICAL-MECHANICAL. LABORATORY PROCEDURES FOR OBTAINING MATERIALS BEHAVIOR INFORMATION IN EACH OF THESE CATEGORIES ARE DESCRIBED. THEY INCLUDE TECHNIQUES FOR DETERMINING SURFACE TEMPERATURE AND EMISSIVITY IN HOT GAS STREAMS; MOLECULAR WEIGHT AND CHEMICAL IDENTITY OF GASEOUS PYROLYSIS PRODUCTS; WEIGHT FRACTIONS OF GASEOUS AND RESIDUAL SOLIDS FROM PYROLYZED PLASTICS; HEAT OF DECOMPOSITION OF PLASTICS; APPARENT THERMAL DIFFUSIVITY AND THERMAL INSULATING CHARACTERISTICS; MECHANICAL PROPERTIES AND CELL STRUCTURES AND OTHER PHYSICAL CHARACTERISTICS OF RESIDUAL CHARS FROM PYROLYZED PLASTICS. SELECTIVE EMPHASIS OF INFORMATION OBTAINED FROM LABORATORY STUDIES FOR USE IN PREDICTING MATERIALS PERFORMANCE IN RE-ENTRY AND PROPULSION ENVIRONMENTS IS DISCUSSED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-363 567 16/4.2 16/3 11/2 11/7
11/9 20/13

AVCO CORP WILMINGTON MASS RESEARCH AND ADVANCED DEVELOPMENT DIV

ABSOLUTE MEASUREMENTS OF RADIATION FROM ABLATING SURFACES. (U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
APR 61 11P RECESSO,J. !

REPT. NO. RAD-9-TM-59-62

CONTRACT: AF04 647 305

PROJ: WS107A2

SCP 4 CONFIDENTIAL REPORT

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 845506

AD-649 694 14/2 20/13 11/2
NATIONAL BUREAU OF STANDARDS WASHINGTON D C
PROCEDURES FOR THE PRECISE DETERMINATION OF THERMAL RADIATION PROPERTIES. (U)
DESCRIPTIVE NOTE: TECHNICAL REPT. FOR 1 NOV 64-31 OCT 65.
AUG 66 88P RICHMOND,J. C. ;KNEISSL,G. J. ;KELLEY,D. L. ;KELLY,F. J. ;
REPT. NO. NBS-TN-292
PROJ: AF-7381
TASK: 738106
MONITOR: AFML TR-66-302

UNCLASSIFIED REPORT
HARD COPY AVAILABLE FROM SUPERINTENDENT OF DOCUMENTS, GPO, WASHINGTON, D. C. 20402 $0.50.
SUPPLEMENTARY NOTE: REPT. ON PROJS. 'MATERIALS APPLICATIONS' AND 'DESIGN INFORMATION DEVELOPMENT.'

DESCRIPTORS: (*THERMAL RADIATION, MEASUREMENT), (*REFRACTORY MATERIALS, THERMAL RADIATION), METERS, INSTRUMENTATION, LASERS, REFLECTOMETERS, CERAMIC MATERIALS, TEST METHODS (U)

THE BROAD OVERALL OBJECTIVE OF THIS CONTINUING PROGRAM IS TO DEVELOP EQUIPMENT AND PROCEDURES FOR MEASURING THE IMPORTANT THERMAL RADIATION PROPERTIES OF MATERIALS, PARTICULARLY THOSE USED IN AIRCRAFT, MISSILES AND SPACE VEHICLES, AT TEMPERATURES UP TO THE MELTING POINT OF THE MOST REFRACTORY MATERIAL, AND TO DEVELOP PHYSICAL STANDARDS FOR CHECKING SUCH EQUIPMENT AND PROCEDURES. DURING THE PERIOD COVERED BY THE REPORT THE SPECIFIC OBJECTIVES WERE (1) CONTINUED DEVELOPMENT OF THE LASER-SOURCE INTEGRATING SPHERE REFLECTOMETER, (2) AN ERROR ANALYSIS OF THE SHALLOW CAVITY TECHNIQUE FOR MEASURING NORMAL SPECTRAL EMITTANCE, AND (3) A STUDY OF THE FEASIBILITY OF PREPARING EMITTANCE STANDARDS FOR USE AT TEMPERATURES ABOVE 1400K (ABOUT 2000F). AN ERROR ANALYSIS OF THE SHALLOW CAVITY TECHNIQUE FOR MEASURING TOTAL NORMAL EMITTANCE OF CERAMIC MATERIALS AT VERY HIGH TEMPERATURES SHOWED THAT THERE WAS AN ERROR DUE TO THE TRANSLUCENCY OF THE SPECIMENS THAT WAS AS MUCH AS +60% FOR ALUMINA, AND A SECOND ERROR DUE TO THERMAL GRADIENTS IN THE SPECIMEN THAT WAS ON THE ORDER OF -10%. TWO NEW TECHNIQUES WERE DEVISED IN THE HOPE OF GREATLY REDUCING THE TRANSLUCENCY ERROR. PROGRESS WAS MADE IN DEVELOPING CODES TO COMPUTE AND CORRECT FOR THE THERMAL GRADIENTS PRESENT IN THE SPECIMEN. THE LASER-SOURCE INTEGRATING SPHERE REFLECTOMETER FOR MEASURING REFLECTANCE OF (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-627 139 11/2 22/2 11/3
IIT RESEARCH INST CHICAGO ILL
EVALUATION OF THERMAL PROTECTIVE SYSTEMS FOR ADVANCED AEROSPACE VEHICLES, VOLUME I. (U)
DESCRIPTIVE NOTE: INTERIM SUMMARY REPT., SEP 62-DEC 63,
APR 65 259P CHRISTIAN,W. J. ;BLITON,J. L. ; DALLY,J. W. ;HEDGE,J. C. ;HIRSCHHORN,H. J. ;
CONTRACT: AF33(657)-9407
PROJ: AF-651G
MONITOR: AFML , TDR-64-204-VOL-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-627 140.

DESCRIPTORS: (*AEROSPACE CRAFT, THERMAL INSULATION), (*REFRACTORY MATERIALS, AEROSPACE CRAFT), COMPATIBILITY, THERMAL PROPERTIES, MECHANICAL PROPERTIES, CERMETS, THERMAL CONDUCTIVITY, REFRACTORY COATINGS, PLASMA MEDIUM, FLAME SPRAYING, THERMAL RADIATION, THERMAL EXPANSION, EVAPOTRANSPIRATION, ALUMINUM COMPOUNDS, OXIDES, NICKEL, ZIRCONIUM COMPOUNDS, NICKEL ALLOYS, CHROMIUM ALLOYS, MAGNESIUM COMPOUNDS, COOLING, POROUS METALS, HAFNIUM COMPOUNDS, HIGH-TEMPERATURE RESEARCH (U)

THE REPORT CONTAINS SUMMARIES OF: SURVEYS OF THE LITERATURE ON STRUCTURAL AND DESIGN ASPECTS OF THERMAL PROTECTION SYSTEMS, ON COMPATIBILITY OF REFRACTORY MATERIALS, ON THERMAL AND MECHANICAL PROPERTIES OF REFRACTORY MATERIALS, AND ON METHODS FOR MEASURING EMITTANCE OF MATERIALS AT HIGH TEMPERATURE. EXPERIMENTAL DETERMINATION OF THE THERMAL CONDUCTANCE OF PLASMA SPRAYED COATINGS OF ALUMINA-NICKEL AND ZIRCONIANICHROME TYPES. MEASUREMENTS OF TOTAL NORMAL EMITTANCE OF MATERIALS IN AN OXIDIZING ATMOSPHERE AT TEMPERATURES OF 1000 TO 4000F. EXPERIMENTAL INVESTIGATIONS OF THE EFFECTS OF COMPOSITION ON THE THERMAL EXPANSION AND TOTAL NORMAL EMITTANCE OF ZIRCONIA AND MAGNESIA. ANALYTICAL AND EXPERIMENTAL STUDIES OF THE GENERAL CHARACTERISTICS AND WEIGHT REQUIREMENTS OF TRANSPIRATION COOLED NOSE CAPS USING POROUS METAL SURFACES. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. B45506

AD-627 140 11/2 22/2 11/6 11/3
IIT RESEARCH INST CHICAGO ILL
EVALUATION OF THERMAL PROTECTIVE SYSTEMS FOR ADVANCED AEROSPACE VEHICLES. VOLUME II: APPENDICES. (U)
DESCRIPTIVE NOTE: INTERIM SUMMARY REPT., SEP 62-DEC 63,
APR 65 579P CHRISTIAN,W. J. ;BLITON,J. L. ;DALLY,J. W. ;HEDGE,J. C.;HIRSCHHORN,H. J. ;
CONTRACT: AF33(657)-9407
PROJ: AF-651G
MONITOR: AFML , TDR-64-204-VOL-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-627 139.

DESCRIPTORS: (*AEROSPACE CRAFT, THERMAL INSULATION), (*REFRACTORY MATERIALS, AEROSPACE CRAFT), TABLES, GRAPHICS, ALUMINUM COMPOUNDS, OXIDES, BERYLLIUM COMPOUNDS, HAFNIUM COMPOUNDS, THORIUM COMPOUNDS, MAGNESIUM COMPOUNDS, SPINELS, ZIRCONIUM COMPOUNDS, NITRIDES, CARBIDES, BORIDES, TEST EQUIPMENT, TEST METHODS, BRITTLENESS, MOLYBDENUM COMPOUNDS, SILICIDES, GRAPHITE, NIOBIUM, MOLYBDENUM, TANTALUM, TUNGSTEN, REFRACTORY METAL ALLOYS, REFRACTORY METALS, THERMAL PROPERTIES, MECHANICAL PROPERTIES, THERMAL CONDUCTIVITY, THERMAL RADIATION, THERMAL EXPANSION, SPECIFIC HEAT (U)

CONTENTS: COMPILATION OF THERMAL AND MECHANICAL PROPERTIES OF REFRACTORY MATERIALS; SURVEY OF METHODS OF MEASURING EMITTANCE; DESCRIPTION OF RADIATION MEASURING SYSTEM. (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 845506

AD-611 945
AVCO CORP WILMINGTON MASS RESEARCH AND ADVANCED DEVELOPMENT DIV
EMITTANCE MEASUREMENTS OF SOLIDS ABOVE 2000 DEG C, (U)

64 7P LASZLO,T. S. ;GANNON,R. E. ; SHEEHAN,P. J. ;
CONTRACT: AF49 638 1166
MONITOR: AFOSR , 65-0164

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PUB. IN SOLAR ENERGY (U. S.) V8 N4 P105-11 OCT-DEC 1964 (COPIES NOT AVAILABLE TO DDC OR CLEARINGHOUSE CUSTOMERS). PRESENTED AT THE SYMPOSIUM ON THERMAL RADIATION OF SOLIDS, SAN FRANCISCO, CALIF., MAR 4-6, 1964.

DESCRIPTORS: (*THERMAL RADIATION, SOLIDS), (*SOLIDS, EMISSIVITY), (*HIGH-TEMPERATURE RESEARCH, THERMAL RADIATION), SOLAR FURNACES, INSTRUMENTATION, BLACKBODY RADIATION, MEASUREMENT, THERMODYNAMICS (U)

A METHOD OF MEASURING THE EMITTANCE OF SOLIDS ABOVE 2000 DEG C THROUGH THE USE OF A SOLAR FURNACE HAS BEEN DEVELOPED. TWO TECHNIQUES INVOLVING SPECIALIZED INSTRUMENTATION, FOR PERFORMING THE NECESSARY MEASUREMENTS WERE INVESTIGATED. INITIAL EXPERIMENTS SHOWED THAT BOTH TECHNIQUES WERE SUITABLE AND THAT THE SPECIFIED INSTRUMENTS WERE ADAPTABLE FOR MAKING THE REQUIRED MEASUREMENTS. (AUTHOR) (U)

A69-41330 ISSUE 23 PAGE 4238 CATEGORY 33 6
9/07/00 UNCLASSIFIED DOCUMENT

The photographic method for the study of spectr al emissivity and spectral distribution of radiati on intensity at high temperatures.

(Spectral emissivity and radiation intensity sp ectral distribution measurements for heat- resista nt materials at high temperature, using photograph ic method)

A/KRUSTALEV, B. A.; B/RAKOV, A. M.

HEAT TRANSFER - SOVIET RESEARCH, VOL. 1, P. 17 9-186. TRANSLATION.

/*HIGH TEMPERATURE TESTS/*PHOTOGRAPHIC MEASURE MENT/*RADIANT FLUX DENSITY/*REFRACTORY MATERIALS/* SPECTRAL EMISSION/*SPECTRAL ENERGY DISTRIBUTION/ B LACK BODY RADIATION/ BRIGHTNESS/ EMISSIVITY/ MOLYB DENUM/ NIOBIUM/ TANTALUM/ THERMAL RESISTANCE

A69-41329 ISSUE 23 PAGE 4237 CATEGORY 33 6
9/07/00 UNCLASSIFIED DOCUMENT

Methods of determining the integral and spectra l radiative properties of materials at high temper atures.

(Heat resistant materials integral and spectral radiative properties in IR and visible regions de termined by calorimetry and IR spectrometer)

A/KHRUSTALEV, B. A.; B/RAKOV, A. M.

HEAT TRANSFER - SOVIET RESEARCH, VOL. 1, P. 16 3-178. TRANSLATION.

/*INFRARED RADIATION/*LIGHT (VISIBLE RADIATION)/*REFRACTORY MATERIALS/*SPECTRAL EMISSION/*SPECTR UM ANALYSIS/ ABSORPTIVITY/ HEAT MEASUREMENT/ INFRA RED SPECTROMETERS/ RADIATION MEASUREMENT/ RADIATIV E HEAT TRANSFER

A69-25230# ISSUE 11 PAGE 1888 CATEGORY 14
69/02/00 UNCLASSIFIED DOCUMENT

Measuring procedure and experimental equipment for determining the integral normal emissivity of structural materials at temperatures ranging from 1200 to 3000 K

(Integral normal emissivity of electrically con ducting materials heated to high temperatures by H F field of inductor, discussing measurement proced ure and equipment)

A/PETROV, V. A.; B/SHEINDLIN, A. E.; C/VINNIK OVA, A. N. (AB/AKADEMIIA NAUK SSSR, NAUCHNO- ISS LEDOVATEL'SKII INSTITUT VYSOKIKH TEMPERATUR, MOSCO W, USSR/.)

TEPLOFIZIKA VYSOKIKH TEMPERATUR, VOL. 7, P. 12 1-126. IN RUSSIAN.

/*EMISSIVITY/*HIGH TEMPERATURE TESTS/*MEASURIN G INSTRUMENTS/*REFRACTORY MATERIALS/ AIRFRAME MATE RIALS/ EXPERIMENTAL DESIGN/ SPACECRAFT CONSTRUCTIO N MATERIALS/ TUNGSTEN

A66-39102# ISSUE 21 PAGE 3738 CATEGORY 14
66/09/00 UNCLASSIFIED DOCUMENT

Temperature and emissivity measurement at 0.65 mu with a solar furnace.

(Imaging techniques to obtain temperature and e missivity measurements and phase diagrams of high melting point ceramic oxides with aid of solar fur nace)

A/KOZUKA, T.; B/NOGUCHI, T. (AA/GOVERNMENT I NDUSTRIAL RESEARCH INST., SOLAR RESEARCH LAB., NAG OYA, JAPAN/.)

/SOLAR ENERGY SOCIETY, ANNUAL MEETING, PHOEN IX, ARIZ., MAR. 15-17, 1965, PAPER./ SOLAR ENERGY , VOL. 10, JUL.-SEP. 1966, P. 125-131. 13 REFS.

/*HIGH TEMPERATURE RESEARCH/*IMAGING TECHNIQUE /*SOLAR FURNACE/*TEMPERATURE MEASUREMENT/ BRIGHTNE SS/ CERAMIC/ CONFERENCE/ EMISSIVITY/ FURNACE/ HIGH TEMPERATURE/ IMAGE/ MEASUREMENT/ MELTING/ OXIDE/ POINT/ PYROMETER/ REFLECTION/ RESEARCH/ SOLAR/ TEM PERATURE

N66-35648*# ISSUE 21 PAGE 4169 CATEGORY 14
NASA-TN-D-3604 66/09/00 UNCLASSIFIED DOCUMENT

Some practical aspects of surface temperature m easurement by optical and ratio pyrometers

(Radiation heat equations and surface temperatu re measurements of opaque materials by optical and ratio pyrometers)

A/BRANSTETTER, J. R.

NATIONAL AERONAUTICS AND SPACE ADMIN STRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO. AVAIL. CFSTI

WASHINGTON, NASA, SEP. 1966 71 P REFS

/*HEAT EQUATION/*OPTICAL PYROMETER/*RADIATIVE HEAT TRANSFER/*SURFACE TEMPERATURE/*TEMPERATURE ME ASUREMENT/ CALIBRATION/ EQUATION/ ERROR/ HEAT TRAN SFER/ MATERIAL/ MEASUREMENT/ OPAQUE/ OPTICAL/ PYRO METER/ RADIATION/ RATIO/ SURFACE/ TEMPERATURE

A66-14985*# ISSUE 5 PAGE 716 CATEGORY 23 6
5/10/00 UNCLASSIFIED DOCUMENT

Thermal emittance behavior of small cavities located on refractory metal surfaces.

(Thermal emittance of cone and cylinder cavities electrically disintegrated in tungsten and molybdenum measured with disappearing-filament pyrometer)

A/BRANSTETTER, J. R.; B/SCHAAL, R. D. (AB/NASA, LEWIS RESEARCH CENTER, CLEVELAND, OHIO/.)

INST. OF ELECTRICAL AND ELECTRONICS ENGINEERS, THERMIONIC CONVERSION SPECIALISTS CONFERENCE, SAN DIEGO, CALIF., OCT. 25-27, 1965, PAPER. 10 P. 12 REFS.

/*REFRACTORY METAL/*SURFACE TEMPERATURE/*THERMAL EMISSION/ CAVITY/ CONFERENCE/ EMISSION/ FILAMENT/ METAL/ MOLYBDENUM/ PYROMETER/ REFRACTORY/ SURFACE/ TEMPERATURE/ THERMAL/ TUNGSTEN

A65-16398 ISSUE 7 PAGE 938 CATEGORY 23 65/
01/00 UNCLASSIFIED DOCUMENT

An infrared band ratio technique for temperature determinations of hot gases.

(IR band ratio technique used for gas temperature determinations of combustion products)

A/FERRISO, C. C.; B/LUDWIG, C. B. (AB/GENERAL DYNAMICS CORP., GENERAL DYNAMICS/ASTRONAUTICS, SPACE SCIENCE LAB., SAN DIEGO, CALIF./.)

APPLIED OPTICS, VOL. 4, JAN. 1965, P. 47-51. 14 REFS. RESEARCH SUPPORTED BY NAVY, AND GENERAL DYNAMICS CORP.

/*HOT GAS/*INFRARED SPECTRUM/*RADIATION EMISSION/*TEMPERATURE MEASUREMENT/ BAND/ COMBUSTION/ DETERMINATION/ EMISSIVITY/ INFRARED/ MEASUREMENT/ RADIATION/ RATIO/ SPECTRUM/ TECHNIQUE/ TEMPERATURE/ VAPOR/ WATER

A64-23265* ISSUE 19 CATEGORY 15 64/00/00 U
NCLASSIFIED DOCUMENT
Equipment for measuring thermal emittance of ce
ramic oxides to 1800 deg k.
(Equipment for measuring total normal emittance
and normal spectral emittance from 1 to 15 micron
s of nonmetals and metals from 1200 to 1800 degree
s k)
A/CLARK, H. E.; B/MOORE, D. G. (AB/NATIONAL
BUREAU OF STANDARDS, WASHINGTON, D.C./.)
IN- SYMPOSIUM ON THERMAL RADIATION OF SOLIDS
, SAN FRANCISCO, CALIF., MAR. 4-6, 1964, SESSION I
II - MEASUREMENT TECHNIQUES. SYMPOSIUM USAF, NATI
ONAL BUREAU OF STANDARDS, AND NASA. BERKELEY, U. O
F CALIFORNIA PRESS, 1964. 25 P. 18 REFS.
/*SPECTRAL EMISSION/*THERMAL EMISSION/ CERAMIC
/ CONFERENCE/ CYLINDER/ EMISSION/ EQUIPMENT/ MATER
IAL/ MEASUREMENT/ NORMAL/ OXIDE/ PLATINUM/ REFLECT
ION/ ROTATION

A64-18391# ISSUE 13 CATEGORY 15 00/00/00 U
NCLASSIFIED DOCUMENT
A review of multicolour pyrometry for temperatu
res below 1500 deg c.
(Multicolor radiation pyrometers for temperatur
es below 1,500 degrees c)
A/REYNOLDS, P. M. (AA/BRITISH NON-FERROUS MET
ALS RESEARCH ASSN., LONDON, ENGLAND/.)
BRITISH JOURNAL OF APPLIED PHYSICS, VOL. 15,
MAY 1964, P. 579-589. 32 REFS.
/*RADIATION PYROMETER/*TEMPERATURE MEASUREMENT
/ ALUMINUM/ BRASS/ EMISSIVITY/ MEASUREMENT/ MULTIC
OLOR/ PYROMETER/ RADIATION/ SPECTRUM/ TEMPERATURE

A63-12567 ISSUE 6 CATEGORY 15 63/01/00 UNC
LASSIFIED DOCUMENT
(Surface temperature measurement using a radiat
ion pyrometer which utilizes a two-beam null-balan
cing technique)
A/KELSALL, D.
AN AUTOMATIC EMISSIVITY-COMPENSATED RADIATI
ON PYROMETER. D. KELSALL /BRITISH SCIENTIFIC INSTR
UMENT RESEARCH ASSOCIATION, CHISLEHURST, KENT, ENG
LAND/. JOURNAL OF SCIENTIFIC INSTRUMENTS, VOL. 40
, JAN. 1963, P. 1-4.
/*RADIATION PYROMETER/*TEMPERATURE MEASUREMENT
/ BALANCE/ BEAM/ COMPENSATION/ EMISSIVITY/ MEASURE
MENT/ NULL/ PYROMETER/ RADIATION/ SURFACE/ TECHNIQ
UE/ TEMPERATURE

N63-82865 : BEC-4247 ASD-TR-61-487 AF 33/616/-74
79 61/10/00 UNCLASSIFIED DOCUMENT
A/MOFFITT, G.
BARNES ENGINEERING CO., STAMFORD, CONN.
BARNES ENGINEERING CO., STAMFORD, CONN. STUD
Y OF A TEMPERATURE MEASURING SYSTEM FOR THE 1000 D
EG C TO 2500 DEG C RANGE <FINAL REPORT, JULY 1, 1
960 - AUG. 31, 1961< GUY MOFFITT WRIGHT-PATTERSON
AFB, OHIO, FLIGHT CONTROL LAB., OCT. 1961 108P 7
2 REFS /CONTRACT AF 33/616/-7479/ /ASD-TR-61-487,
BEC-4247/
/ EMISSIVITY/ ENVIRONMENT/ HIGH TEMPERATURE/ M
EASUREMENT/ RADIOMETER/ SENSITIVITY/ SOLID/ SURFAC
E/ SYSTEM/ ULTRAVIOLET

N63-16653# ISSUE 14 CATEGORY 15 ASD-TR-61-48
7 AD-274794 AF 33/616/-7479 62/02/00 UNCLASS
IFIED DOCUMENT
(Ultraviolet radiometer for automatic measureme
nts of surface temperatures in 1000 to 2500-deg c
region)
A/MOFFITT, G.
BARNES ENGINEERING CO., STAMFORD, CONN.

/*HIGH TEMPERATURE RESEARCH/*RADIOMETER/*SURFA
CE TEMPERATURE/*TEMPERATURE MEASUREMENT/*ULTRAVIOL
ET RADIATION/ AIRBORNE/ AUTOMATION/ CALIBRATION/ C
ONSTRUCTION/ DESIGN/ EMISSIVITY/ FLUCTUATION/ HIGH
TEMPERATURE/ LAMP/ MEASUREMENT/ MOLYBDENUM/ NUCLE
AR/ OXIDATION/ RADIATION/ REFERENCE/ STRIP/ SURFAC
E/ TEMPERATURE/ TRANSDUCER/ TUNGSTEN/ ULTRAVIOLET/
VEHICLE

N70-21467# ISSUE 9 PAGE 1632 CATEGORY 14 A
D-697761 AFML-TR-69-39-277 F33615-69-C-1229 69
/10/00 UNCLASSIFIED DOCUMENT
Determination of thermal and electrical conduct
ivity, emittance and Thomson coefficient at high t
emperatures by direct heating methods Technical r
eport, 1 Jul. 1968 - 30 Jun. 1969
(Thermal and electrical conductivity, emittance
, and Thomson coefficient measurements at high tem
peratures by direct heating methods)
A/DAVIS, F. E.; B/KIMBROUGH, W. D.; C/POWELL,
R. W.; D/TAYLOR, R. E.
PURDUE UNIV., LAFAYETTE, IND. (THERMOPHYSICAL
PROPERTIES RESEARCH CENTER.) AVAIL. CFSTI

/*ELECTRICAL RESISTIVITY/*EMITTANCE/*HIGH TEMP
ERATURE RESEARCH/*THERMAL CONDUCTIVITY/*THERMOELEC
TRICITY/ GRAPHITE/ RESISTANCE HEATING/ TANTALUM/ T
UNGSTEN

N68-19567# ISSUE 8 PAGE 1440 CATEGORY 33 6
8/00/00 UNCLASSIFIED DOCUMENT
Methods of determining the integral and spectra
l radiative properties of materials at high temper
atures
(Spectral and integral radiative properties of
heat resistant materials at high temperatures)
A/RAKOV, A. M.
LOCKHEED MISSILES AND SPACE CO., SUNNYVALE, CAL
IF. AVAIL- NATIONAL TRANSLATIONS CENTER, JOHN C
RERAR LIBRARY, CHICAGO, ILL. 60616
TRANSL. INTO ENGLISH FROM THE BOOK ''TEPLOO
BMEN, GIDRODINAMIKA I TEPLOFIZICHESKIE SVOISTVA VE
SHCHESTVA'' MOSCOW, IZD. AN SSSR, 1968 P 174-190
/*HIGH TEMPERATURE ENVIRONMENTS/*RADIATIVE HEA
T TRANSFER/*REFRACTORY MATERIALS/*THERMODYNAMIC PR
OPERTIES/ BIBLIOGRAPHIES/ BLACK BODY RADIATION

N68-14019*# ISSUE 5 PAGE 658 CATEGORY 14 N
ASA-TT-F-11407 NASW-1695 67/12/00 UNCLASSIFI
ED DOCUMENT
Photographic pyrometry
(Photographic pyrometry techniques and applicat
ions in high temperature physics)
A/SHRAMKO, YU. N.
TECHTRAN CORP., GLEN BURNIE, MD. AVAIL. CFST
I
WASHINGTON NASA TRANSL. INTO ENGLISH FROM
TEPLOFIZ. BYSOKIKH TEMPERATUR, AKAD. NAUK SSSR /MO
SCOW/, V. 5, NO. 2, 1967 P 367-372
/*HIGH TEMPERATURE RESEARCH/*PHOTOGRAPHIC MEAS
UREMENT/*PYROMETERS/*TEMPERATURE MEASUREMENT/ BRIG
HTNESS/ EMISSIVITY/ ERROR ANALYSIS/ PHOTOGRAPHS/ T
EMPERATURE DISTRIBUTION/ THERMAL RADIATION

N66-22418# ISSUE 12 PAGE 2235 CATEGORY 33
NBS-TN-267 AD-628586 65/12/17 UNCLASSIFIED DOC
UMENT

Procedures for precise determination of thermal radiation properties, November 1963 to October 19 64

(Laser source reflectometer to measure reflecta nce of specimens at high temperature - relation of thermal emission to other optical properties)

A/DE WITT, D. P.; B/DUNN, S. T.; C/HAYES, W. D., JR.; D/RICHMOND, J. C.

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.

AVAIL. CFSTI

17 DEC. 1965 77 P REFS PREPARED FOR AF

/*LASER/*OPTICAL PROPERTY/*REFLECTOMETER/*THER MAL EMISSION/ BEHAVIOR/ COEFFICIENT/ ELECTROMAGNET IC/ EMISSION/ HIGH TEMPERATURE/ MEASUREMENT/ OPTIC AL/ PROPERTY/ QUANTUM/ RADIATION/ REFLECTION/ RHOD IUM/ SOURCE/ SPHERE/ THEORY/ THERMAL

N64-13971# ISSUE 5 CATEGORY 13 WADC-TR-59-51 0, PT. 4 AD-426842 AF 33/616/-61-02 63/11/00 UNCLASSIFIED DOCUMENT

Standardization of thermal emittance measuremen ts. part iv- normal spectral emittance, 800-1400 deg. K technical report, 1 jul. 1958-31 oct. 196 2

(Measurement of normal spectral emittance of sp ecimens at temperatures in 800 to 1400-deg k range)

A/HARRISON, W. N.; B/JOSEPH, H. M.; C/RICHMON D, J. C.; D/SHORTEN, F. J.

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.

WRIGHT-PATTERSON AFB, OHIO, AF MATERIALS LAB ., NOV. 1963 97 P

/*SPECTRAL EMISSION/ CALIBRATION/ EMISSION/ EM ISSIVITY/ EQUIPMENT/ HIGH TEMPERATURE/ LENGTH/ MEA SUREMENT/ PROCEDURE/ SPECTRUM/ STANDARD/ WAVE

N64-10968* ISSUE 2 CATEGORY 13 AF 33/616/-73 19 63/00/00 UNCLASSIFIED DOCUMENT

Some problems in emittance measurements at the higher temperatures and surface characterization

(Emittance measurement for refractory materials to 5000 deg f - temperature & structure dependence)

A/PEARS, C. D.

SOUTHERN RESEARCH INST., BIRMINGHAM, ALA.

IN NASA MEASUREMENT OF THERMAL RADIATION PROPERTIES OF SOLIDS 1963 P 541-551 REFS /SEE N64-10937 02-01/ GPO- $3.50

/*EMISSION/*HIGH TEMPERATURE RESEARCH/*REFRACTORY MATERIAL/ ANALYSIS/ DEPENDENCE/ EMISSIVITY/ ERROR/ MATERIAL/ OPTICS/ PYROMETRY/ REFRACTORY/ STRUCTURE/ SURFACE/ TEMPERATURE/ THERMOCOUPLE/ VERY HIGH

N64-10966* ISSUE 2 CATEGORY 13 63/00/00 UNCLASSIFIED DOCUMENT

Evaluation of thermal radiation at high temperatures

(Emittance measuring apparatus for temperatures up to 4000-deg f)

A/KLEMM, R.; B/KONOPKEN, S.

NORTH AMERICAN AVIATION, INC., LOS ANGELES, CALIF.

IN NASA MEASUREMENT OF THERMAL RADIATION PROPERTIES OF SOLIDS 1963 P 505-513 REFS /SEE N64-10937 02-01/ GPO- $3.50

/*EMISSION/*HIGH TEMPERATURE RESEARCH/*MEASURING APPARATUS/*THERMAL RADIATION/ APPARATUS/ BLACK/ BODY/ EMISSIVITY/ EQUIPMENT/ HIGH TEMPERATURE/ MATERIAL/ RADIATION/ TEST/ THERMAL/ TRANSPARENCY

N64-10965* ISSUE 2 CATEGORY 13 ASD-TR-61-706, VOL. 2 AF 33/616/-7050 63/00/00 UNCLASSIFIED DOCUMENT

Emittance measurement capability for temperatures up to 3000 deg f

(Emittance measurement for temperatures to 3000-deg f to provide data on thermal radiation of ceramics for reentry vehicle use)

A/KJELBY, A. S.

AERONCA MFG. CORP., MIDDLETOWN, OHIO.

IN NASA MEASUREMENT OF THERMAL RADIATION PROPERTIES OF SOLIDS 1963 P 499-503 /SEE N64-10937 02-01/ GPO- $3.50

/*CERAMICS/*EMISSION/*HIGH TEMPERATURE RESEARCH/*THERMAL RADIATION/ BLACK/ BODY/ EMISSIVITY/ HEAT/ HEMISPHERE/ HIGH TEMPERATURE/ RADIATION/ REENTRY/ SHIELD/ THERMAL/ VEHICLE

N64-10964* ISSUE 2 CATEGORY 13 63/00/00 UNCLASSIFIED DOCUMENT

A very rapid 3000 deg f technique for measuring emittance of opaque solid materials

(Total normal emittance measurement technique for opaque solid materials over 1000- to 3000-deg f range)

A/CLAYTON, W. A.; B/EVANS, R. J.; C/FRIES, M.

BOEING CO., SEATTLE, WASH.

IN NASA MEASUREMENT OF THERMAL RADIATION PROPERTIES OF SOLIDS 1963 P 483-488 /SEE N64-10937 02-01/ GPO- $3.50

/*EMISSION/*HIGH TEMPERATURE RESEARCH/*OPACITY/*SOLIDS/ ACCURACY/ ANALYSIS/ BODY/ EMISSIVITY/ ERROR/ GRAY/ HIGH TEMPERATURE/ OPAQUE/ OPTICS/ PYROMETER/ SOLID

N64-10958* ISSUE 2 CATEGORY 15 WADD-TR-60-102 AF 33/616/-5925 63/00/00 UNCLASSIFIED DOCUMENT

Instrumentation for emittance measurements in the 400 deg to 1800 deg f temperature range

(Instrumentation for simultaneous measurement of spectral and normal emittance of materials in ambient and vacuum environment at high temperature)

A/BASTIAN, R.; B/DYER, J.; C/GRAVINA, A.

REPUBLIC AVIATION CORP., FARMINGDALE, N. Y.

IN NASA MEASUREMENT OF THERMAL RADIATION PROPERTIES OF SOLIDS 1963 P 329-336 FOR COMPLETE DESCRIPTION, SEE WADD-TR-60-102, FINAL REPT. /SEE N64-10937 02-01/ GPO- $3.50

/*EMISSION/*HIGH TEMPERATURE RESEARCH/*INSTRUMENTATION/*VACUUM/ AMBIENT/ EMISSIVITY/ ENVIRONMENT/ GAS/ HIGH TEMPERATURE/ MATERIAL/ NORMAL/ SPECTRAL

N62-12980# ISSUE 9 CATEGORY 21 WADD-TR-60-67
6, PT. II AF 33/616/-6570 62/02/00 UNCLASSIF
IED DOCUMENT

(Optical methods of measuring plasma jet temper
atures - measurement by photoelectric pyrometry)

A/DUNDAS, P. H.; B/HOTTEL, H. C.; C/JENSEN, W
. P.; D/WILLIAMS, G. C.

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. OPT
ICAL METHODS OF MEASURING PLASMA JET TEMPERATURES.
PART II- MEASUREMENT BY PHOTOELECTRIC PYROMETRY.
<FINAL< TECH. DOC. REPT. <COVERING PERIOD OF OCT
. 1960 TO AUG. 1961.< H. C. HOTTEL, G. C. WILLIAMS
, P. H. DUNDAS, AND W. P. JENSEN. WRIGHT-PATTERSON
AFB, OHIO, DIRECTORATE OF MATERIALS AND PROCESSES
, FEB. 1962. 52 P. 77 REFS. /CONTRACT AF 33/616/
-6570/ /WADD-TR-60-676, PT. II/

/*JET/*OPTICAL MEASUREMENT/*PHOTOELECTRICITY/*
PLASMA JET/*PYROMETRY/ BEER LAW/ BROADENING/ CALIB
RATION/ D-LINE/ DETECTOR/ DOUBLET/ EFFECT/ ELECTRO
NICS/ EMISSION/ EMISSIVITY/ FILAMENT/ FILTER/ FREQ
UENCY/ INDICATION/ INTEGRAL/ INTERFERENCE/ LAW/ LI
NE/ MEASUREMENT/ METHOD/ NOISE/ OPACIFIER/ OPTICAL
/ OPTICS/ PHOTOMULTIPLIER/ PLASMA/ PROBABILITY/ PR
OBE/ PYROMETER/ RADIANCE/ RATIO/ SHAPE/ SIGNAL/ SO
DIUM/ SOURCE/ SPECTRUM/ TEMPERATURE/ THEORY/ TRANS
PARENCY/ UNKNOWN

X66-10479 ISSUE 2 PAGE 185 CATEGORY 33 64/
01/00 UNCLASSIFIED DOCUMENT GOVT. AGCY. ONLY

The problem of accurately measuring changing te
mperatures of non-metallic surfaces

(Calibration of optical pyrometer for accurate
measurement of temperature changes of nonmetallic
surfaces)

A/SKLAREW, S.

MARQUARDT CORP., VAN NUYS, CALIF.

IN AFSC SUM. OF THE 8TH REFRACTORY COMPOSIT
ES WORKING GROUP MEETING, VOL. I JAN. 1964 P 92-1
17 REFS /SEE X66-10476 02-15/

/*CALIBRATION/*NONMETAL/*OPTICAL PYROMETER/*SU
RFACE TEMPERATURE/*TEMPERATURE MEASUREMENT/ BLACK/
BODY/ CONFERENCE/ EMISSION/ EMISSIVITY/ GRADIENT/
HEATING/ INSTRUMENT/ MEASUREMENT/ RADIATION/ SPEC
TRAL/ STANDARDIZATION/ SURFACE/ TEMPERATURE/ THERM
OCOUPLE

X66-10067 ISSUE 1 PAGE 87 CATEGORY 33 65/0
8/00 UNCLASSIFIED DOCUMENT GOVT. AGCY. ONLY
Air Force sponsored studies on high temperature emittance at the National Bureau of Standards
(Measurement techniques and working standards for thermal emittance - Calibration of ellipsoidal mirror and laser reflectometers)
A/MINGES, M. L.; B/STEVISON, D. F.
AIR FORCE SYSTEMS COMMAND, WRIGHT- PATTERSON AFB, OHIO. (AIR FORCE MATERIALS LAB.)
IN AFSC SUM. OF THE TENTH REFRACTORY COMPOSITES WORKING GROUP MEETING AUG. 1965 P 889-895 REFS /SEE X66-10016 01-17/
/*CALIBRATION/*MIRROR/*REFLECTOMETER/*THERMAL EMISSION/ COATING/ COMPOSITE/ CONFERENCE/ ELLIPSOID/ EMISSION/ INCONEL/ LASER/ MEASUREMENT/ PLATINUM/ REFRACTORY/ SPHERE/ STANDARDIZATION/ TECHNIQUE/ THERMAL

GROUP 6

Concerning radiative heat transfer to and from vehicles in high-velocity, reentry-type environments.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-861 746L 22/3 20/13 22/2
GENERAL DYNAMICS/ASTRONAUTICS SAN DIEGO CALIF
A NOTE ON RADIATIVE HEATING TO RE-ENTERING VEHICLES, (U)
JUN 62 29P JAZWINSKI,A. H. I
REPT. NO. GDA-ERR-AN-148

UNCLASSIFIED REPORT
DISTRIBUTION: USGO: OTHERS TO GENERAL DYNAMICS/ CONVAIR, P. O. BOX 12009, SAN DIEGO, CALIF. 92112.
SUPPLEMENTARY NOTE: SEE ALSO AD-861 752L.

DESCRIPTORS: (*ATMOSPHERE ENTRY, *LIFTING REENTRY VEHICLES), THERMAL RADIATION, THERMODYNAMICS, AERODYNAMIC HEATING, NOSE CONES, AERODYNAMIC CONFIGURATIONS, EMISSIVITY, THEORY, SHOCK WAVES, DELTA WINGS, VIBRATION, DISSOCIATION, NONEQUILIBRIUM FLOW, STAGNATION POINT, INTENSITY, DESCENT TRAJECTORIES, MOLECULAR ENERGY LEVELS, MOLECULAR ROTATION (U)
IDENTIFIERS: RADIATIVE EQUILIBRIUM HEATING, RADIATIVE NON-EQUILIBRIUM HEATING, EQUILIBRIUM RADIATION, KIRCHHOFF LAW, GAS CAPS, RADIATIVE HEATING (U)

RADIATIVE HEATING TO RE-ENTERING VEHICLES WAS EXAMINED. IT WAS FOUND THAT EQUILIBRIUM RADIATIVE HEATING TO THE STAGNATION POINT, AS HITHERTO CALCULATED, OVERESTIMATES THE ACTUAL HEATING BY 20-25% BECAUSE OF THE POOR APPROXIMATION TO THE ACTUAL GEOMETRY INVOLVED. FURTHER, IT WAS SHOWN WITH THE AID OF PREVIOUS WORK THAT THE DISREGARD OF THE SELF-ABSORPTION OF THE GAS MAY LEAD TO SERIOUS OVERESTIMATES OF EQUILIBRIUM RADIATIVE HEATING UNDER CERTAIN FLIGHT AND VEHICLE SITUATIONS. RELATIONS WERE PRESENTED WHICH CORRECT THESE ERRORS FOR A SPHERICAL STAGNATION POINT AND AN INFINITE RADIATING SLAB. IT WAS POINTED OUT HOW OTHER VEHICLE SHAPES SHOULD BE ANALYZED. THE RESULTS WERE APPLIED TO THE DELTA WING SHAPE. EQUATIONS WERE DERIVED WHEREBY RADIATIVE EQUILIBRIUM HEATING MAY BE CALCULATED AT THE STAGNATION POINT AND SOME POINT AFT ON THE UNDERSIDE OF THE WING AT ANGLE OF ATTACK. IT WAS CONCLUDED THAT ESTIMATES OF NON-EQUILIBRIUM HEATING ARE VERY UNCERTAIN. THIS DOES NOT REMOVE THE EXISTING PROBLEM, HOWEVER. IT WAS POINTED OUT WHERE DATA ON NON-EQUILIBRIUM HEATING MAY BE OBTAINED. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-818 889L 22/2 20/13 16/4
AVCO EVERETT RESEARCH LAB EVERETT MASS
RADIATION FROM THE BOUNDARY LAYER OF A SLENDER
NONABLATING CONE. (U)
DESCRIPTIVE NOTE: RESEARCH REPT.,
JUN 67 51P TEXTORIS,A. ICAMAC,M. I
REPT. NO. AERL-RR-278
CONTRACT: AF 04(694)-865
MONITOR: BSD TR-67-132

UNCLASSIFIED REPORT
DISTRIBUTION: USGO: OTHERS TO SPACE AND MISSILE
SYSTEMS ORGANIZATION, ATTN: SMSDM-1. NORTON
AFB, CALIF. 92409.

DESCRIPTORS: (*NOSE CONES, THERMAL RADIATION),
BOUNDARY LAYER, EMISSIVITY, HIGH ALTITUDE,
HYPERSONIC CHARACTERISTICS, INFRARED RADIATION,
MOLECULAR SPECTROSCOPY, OXYGEN, NITROGEN,
NITROGEN OXIDES, CARBON DIOXIDE,
SPECTRA(INFRARED), INTENSITY, CONICAL BODIES,
SLENDER BODIES, MATHEMATICAL PREDICTION, REENTRY
VEHICLES, EXCITATION, SHOCK WAVES (U)
IDENTIFIERS: SHARP BODIES (U)

THE RADIATION EMISSION FROM THE SIDEWALL BOUNDARY LAYER IS ESTIMATED FOR SEVERAL NONABLATING CONICAL BODIES. DETAILED RADIATION PROFILES ARE PRESENTED FOR 6, 8, AND 10 DEGREE HALF-ANGLE CONES AT 150 K-FT ALTITUDE AND FOR AN 8 DEGREE CONE AT 115K-FT AND 200 K-FT ALTITUDES, ALL AT A VELOCITY OF 22 K-FT/SEC. THE MAJOR SOURCES OF RADIATION ARE FROM MOLECULAR BANDS: O2 (SR), N2 (1+) AND (2+), NO (BETA) AND (GAMMA), INFRARED NO (5.3 AND 2.7 MICRONS), AND CO2(4.3 AND 2.7 MICRONS). THE INTENSITIES ARE CALCULATED ASSUMING EQUILIBRIUM (LTE) AND COLLISION-LIMITED RADIATION. FOR LTE, THERE IS THERMODYNAMIC EQUILIBRIUM OF THE INTERNAL MODES (VIBRATIONAL AND ELECTRONIC) WITH LOCAL TRANSLATIONAL TEMPERATURE. IN THE NONEQUILIBRIUM (NON-LTE) EXCITATION CASE, DETAILED KNOWLEDGE OF THE EXCITATION AND QUENCHING RATE CONSTANTS IS NEEDED: UNFORTUNATELY ONLY A FEW OF THEM HAVE BEEN MEASURED. WHERE NO MEASUREMENTS EXIST, WE HAVE ASSIGNED TENTATIVE VALUES TO THE RATE CONSTANTS. THE NON-LTE INTENSITY IS SEVERAL ORDERS OF MAGNITUDE BELOW THAT FOR EQUILIBRIUM. A TYPICAL NON-LTE INTENSITY AT 115 K-FT ALTITUDE INTEGRATED OVER A 10-FOOT-LONG 8 DEGREE CONE IS 0.1 WATT/STER FOR O2 (SR) BAND SYSTEM. IN COMPARISON, THE RADIATION FROM THE NORMAL SHOCK OVER A 1 CM NOSE RADIUS IS ABOUT 0.3 (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-815 183L 22/2 20/4
GENERAL ELECTRIC CO PHILADELPHIA PA MISSILE AND SPACE DIV
GLOW ANALYSIS REPORT. CHARTS OF EQUILIBRIUM AIR EMISSION IN THE STAGNATION REGION OF A BLUNT BODY. (U)
DESCRIPTIVE NOTE: REPORT ON ADVANCED RE-ENTRY TECHNOLOGY PROGRAMS,
JUN 67 26P ALYEA,F. N. 1
REPT. NO. 67SD1500
CONTRACT: DA-01-021-AMC-13812(Z), ARPA ORDER-453

UNCLASSIFIED REPORT
DISTRIBUTION: DOD ONLY; OTHERS TO ARMY MISSILE COMMAND, ATTN: AMSMI-RNR. REDSTONE ARSENAL, ALA. 35809.

DESCRIPTORS: (*REENTRY VEHICLES, THERMAL RADIATION), STAGNATION POINT, BLUNT BODIES, HIGH ALTITUDE, LOW ALTITUDE, SPECTRA(VISIBLE + ULTRAVIOLET), SPECTRA(INFRARED), EMISSIVITY, CHEMILUMINESCENCE, NITROGEN OXIDES, MATHEMATICAL MODELS, MATHEMATICAL PREDICTION, THERMAL RADIATION (U)
IDENTIFIERS: GRAPHS(CHARTS), GLOW PROJECT (U)

CALCULATIONS HAVE BEEN MADE OF THE EQUILIBRIUM, OPTICALLY-THIN EMISSION FROM SHOCK-HEATED AIR AT STAGNATION CONDITIONS AND PRESENTED GRAPHICALLY AS A FUNCTION OF VELOCITY AND ALTITUDE FOR TWELVE 500 A SPECTRAL BANDWIDTHS BETWEEN 3500 AND 9000 A. THE ALTITUDE (0 TO 100 KFT) AND VELOCITY (6 TO 23 KFPS) RANGES WERE SELECTED TO PROVIDE COVERAGE OF ICBM RE-ENTRIES. IT WAS FOUND THAT THE CONTRIBUTION OF NO2 THERMAL RADIATION AND NO PLUS O CHEMILUMINESCENCE ACCOUNTED FOR APPROXIMATELY 50 PERCENT OF THE EMISSION AT 12 KFPS AND THAT THE RELATIVE CONTRIBUTION INCREASED WITH DECREASING VELOCITY. (AUTHOR) (U)

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-452 421
CORNELL AERONAUTICAL LAB INC BUFFALO N Y
STUDY OF INFRARED EMISSION FROM HYPERSONIC AIR FLOWS. (U)
DESCRIPTIVE NOTE: FINAL REPT., SEP 61-OCT 64,
NOV 64 56P WURSTER,WALTER H. I
REPT. NO. CM1626A16
CONTRACT: DA30 0690RD3443 ,SD59 2
PROJ: DA30 0690RD3443 ,SD59 2

UNCLASSIFIED REPORT
NOFORN
SUPPLEMENTARY NOTE:

DESCRIPTORS: (*HYPERSONIC FLOW, SPECTRA (INFRARED)), (*REENTRY VEHICLES, EMISSIVITY), ATMOSPHERE ENTRY, BLUNT BODIES, NOSE CONES, EXPERIMENTAL DATA, AIR, NITROGEN COMPOUNDS, OXIDES, DIOXIDES, NONEQUILIBRIUM FLOW, SHOCK WAVES, NUMERICAL METHODS AND PROCEDURES, OPTICAL PROPERTIES, COMPUTERS, HYPERSONIC TEST VEHICLES, THERMAL RADIATION, GAS IONIZATION, INFRARED RADIATION (U)
IDENTIFIERS: FLOW FIELD, TRAILBLAZER, GAS CAP (U)

THE PURPOSE OF THE PROGRAM IS TO PERFORM BASIC EXPERIMENTAL MEASUREMENTS AND THEORETICAL ANALYSES DESIGNED TO EXTEND THE KNOWLEDGE REQUIRED TO UNDERSTAND THE PHYSICAL AND CHEMICAL PROPERTIES OF HYPERSONIC AIR FLOWS ABOUT REENTRY VEHICLES. A PRIMARY OBJECTIVE WAS THE DESCRIPTION OF THE OPTICAL RADIATION (ESPECIALLY IN THE NEAR INFRARED) FROM THE GAS CAP OF BLUNT REENTRY BODIES. THE WORK HAS BEEN DIVIDED INTO TWO PRIMARY PHASES: RADIATION MEASUREMENTS AND REENTRY FLOW FIELD ANALYSIS. THE GENERAL APPROACH TO THE PROBLEM OF EXPERIMENTAL RADIATION IS DEFINED, AND THE STATUS OF THE RESEARCH AT THE BEGINNING OF THIS CONTRACT IS SUMMARIZED. AN ACCOUNT OF THE FLOW FIELD ANALYSIS PHASE OF THE CONTRACT IS NEXT PRESENTED, GIVING THE GENERAL INVERSE METHOD OF SOLUTION AND THE STATUS OF THE NONEQUILIBRIUM BOW AND NORMAL SHOCK WAVE COMPUTER PROGRAMS. THE PRESENT CAPABILITIES AND LIMITATIONS OF THE EXACT NUMERICAL METHODS ARE SUMMARIZED AND CALCULATIONS ARE MADE TO DETERMINE THE OPTICAL RADIATION TO BE EXPECTED FROM A TRAILBLAZER REENTRY VEHICLE OF 1 FOOT DIAMETER AND ABOUT 20 KFT VELOCITY. FINALLY THE OVER-ALL PROBLEM OF OPTICAL RADIATION FROM THE GAS CAP IS REVIEWED. (AUTHOR) (U)

A70-11625 ISSUE 1 PAGE 219 CATEGORY 33 69/02/00 UNCLASSIFIED DOCUMENT

Problems of radiant transfer in hypersonic aerodynamics.

(Radiant heat transfer in hypersonic aerodynamic heating, discussing radiant flux and carbon dioxide concentration in reentry problems)

A/KONKOV, A. A.; B/NEILAND, V. IA.; C/NIKOLAEV, V. M.; D/PLASTININ, IU. A.

HIGH TEMPERATURE, VOL. 7, P. 126-150. /TEPLOFIZIKA VYSOKIKH TEMPERATUR, VOL. 7, JAN.-FEB. 1969, P. 140-164./ TRANSLATION.

/*AERODYNAMIC HEATING/*HYPERSONIC REENTRY/*RADIATIVE HEAT TRANSFER/*REENTRY VEHICLES/ CARBON DIOXIDE CONCENTRATION/ CONVECTIVE HEAT TRANSFER/ FLUX DENSITY/ HYPERSONIC FLIGHT/ MARS ATMOSPHERE/ STAGNATION POINT

A69-34447 ISSUE 18 PAGE 3116 CATEGORY 11 69/05/00 UNCLASSIFIED DOCUMENT

Radiation gas dynamics in the shock tube.

(Radiation gas dynamics in shock tube, studying radiation coupled flows with flow field affected by radiant energy transport)

A/GRIFFITH, W. C.; B/WOOD, A. D. (AB/LOCKHEED AIRCRAFT CORP., LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF./.)

PHYSICS OF FLUIDS, VOL. 12, PT. 2, SUPPLEMENT I, P. I-30 TO I-36. /INTERNATIONAL SHOCK TUBE SYMPOSIUM, 6TH, UNIVERSITAET FREIBURG, FREIBURG IM BREISGAU, WEST GERMANY, APR. 12-14, 1967./

/*ENERGY TRANSFER/*GAS DYNAMICS/*RADIATIVE HEAT TRANSFER/*SHOCK HEATING/*SHOCK TUBES/ ARC HEATING/ CONFERENCES/ CONTINUOUS RADIATION/ FLOW DISTRIBUTION/ HIGH TEMPERATURE RESEARCH/ LUMINOUS INTENSITY/ THERMODYNAMICS/ ULTRAVIOLET RADIATION

A69-14597 ISSUE 4 PAGE 685 CATEGORY 33 68/00/00 UNCLASSIFIED DOCUMENT

Radiation and Reentry.

(Monograph on radiation gas dynamics, thermal radiation, applied spectroscopy and ablation and applications in high speed atmospheric entry)

A/OLFE, D. B.; B/PENNER, S. S. (AA/CALIFORNIA, U., DEPT. OF THE AEROSPACE AND MECHANICAL ENGINEERING SCIENCES, LA JOLLA, CALIF./.) $24.

NEW YORK, ACADEMIC PRESS, INC., RESEARCH SUPPORTED BY THE U.S. NAVY AND THE ADVANCED RESEARCH PROJECTS AGENCY.

/*ATMOSPHERIC ENTRY/*GAS DYNAMICS/*RADIATION EFFECTS/*REENTRY PHYSICS/*THERMAL RADIATION/ ABLATION/ ASTROPHYSICS/ RADIATIVE HEAT TRANSFER/ SPECTROSCOPY

A67-17336*# ISSUE 5 PAGE 928 CATEGORY 33 AIAA PAPER 66-106 NAS7-295 67/01/00 UNCLASSIFIED DOCUMENT

Convective and radiative heat transfer during superorbital entry.

(Convective and radiative heat transfer to reentry vehicles at superorbital velocities)

A/HOSHIZAKI, H.; B/WILSON, K. H. (AB/LOCKHEED AIRCRAFT CORP., LOCKHEED MISSILES AND SPACE CO., RESEARCH LABS., PALO ALTO, CALIF./.)

/AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, AEROSPACE SCIENCES MEETING, 3RD, NEW YORK, N. Y., JAN. 24-26, 1966, PAPER 66- 106./ AIAA JOURNAL, VOL. 5, JAN. 1967, P. 25- 35. 30 REFS. <FOR ABSTRACT SEE ISSUE 07, PAGE 1155, ACCESSION NO. A66-18459<

/*CONVECTIVE HEAT TRANSFER/*PLANETARY RADIATION/*RADIATIVE HEAT TRANSFER/*REENTRY EFFECT/ ABSORPTION/ ATMOSPHERE/ CONFERENCE/ CONVECTION/ COOLING/ EFFECT/ EMISSION/ HEAT TRANSFER/ LAYER/ ORBITAL/ PLANETARY/ RADIATION/ RADIATIVE/ REENTRY/ SHOCK/ THERMAL/ VEHICLE/ VELOCITY

A68-37279*# ISSUE 19 PAGE 3693 CATEGORY 33
NAS7-386 68/08/00 UNCLASSIFIED DOCUMENT
Convective and radiative heat transfer to an ablating body.
(Convective and radiative heat transfer to reentry vehicles protected by ablation heat shields)
A/HOSHIZAKI, H.; B/LASHER, L. E. (AB/LOCKHEED AIRCRAFT CORP., LOCKHEED MISSILES AND SPACE CO., RESEARCH LABS., PALO ALTO, CALIF./.)
AIAA JOURNAL, VOL. 6, P. 1441-1449.
/*ABLATION/*ATMOSPHERIC ENTRY/*CONVECTIVE HEAT TRANSFER/*HEAT SHIELDING/*RADIATIVE HEAT TRANSFER/ AEROTHERMOCHEMISTRY/ COOLING/ MASS TRANSFER/ PYROLYSIS/ REENTRY PHYSICS/ REENTRY VEHICLES/ SHOCK LAYERS/ THERMAL ABSORPTION

A66-25154 ISSUE 13 PAGE 1989 CATEGORY 1 AF-AFOSR-353-63 NONR-1841/93/ 66/00/00 UNCLASSIFIED DOCUMENT
Entry heat transfer at superorbital speeds.
(Estimates of expected relative magnitudes of convective and radiative heat transfer at stagnation point of blunt body for superorbital speeds and altitudes with continuum flow)
A/FAY, J. A. (AA/MASSACHUSETTS INST. OF TECH., DEPT. OF MECHANICAL ENGINEERING, CAMBRIDGE, MASS./.)
IN- FUNDAMENTAL PHENOMENA IN HYPERSONIC FLOW, PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM, BUFFALO, N.Y., JUN. 25, 26, 1964. <A66-25152 13-12<
SYMPOSIUM SPONSORED BY THE CORNELL AERONAUTICAL LAB. EDITED BY J. G. HALL. ITHACA, N.Y., CORNELL U. PRESS, 1966, P. 30-46, PREPARED COMMENT, H. HOSHIZAKI /LOCKHEED AIRCRAFT CORP., LOCKHEED MISSILES AND SPACE CO., PALO ALTO, CALIF./, P. 46-50, AUTHOR'S REPLY, P. 50, 51, FLOOR DISCUSSION, D. E. ROSNER /AEROCHEM RESEARCH LABS., INC., PRINCETON, N.J./, P. 51. 39 REFS.
/*BLUNT BODY/*CONTINUUM FLOW/*CONVECTIVE HEAT TRANSFER/*HYPERSONIC HEAT TRANSFER/*RADIATIVE HEAT TRANSFER/*STAGNATION POINT/ BLUNT/ BODY/ CONFERENCE/ CONTINUUM/ CONVECTION/ FLIGHT/ FLOW/ HEAT TRANSFER/ HYPERSONIC/ IONIZATION/ LAYER/ POINT/ RADIATIVE/ SHOCK/ STAGNATION/ VELOCITY

A64-26664# ISSUE 23 CATEGORY 2 AF 33/657/-10
110 00/00/00 UNCLASSIFIED DOCUMENT

Shock layer radiation during hypervelocity re-entry.

(Shock layer thermal radiation during simulated hypervelocity reentry, determining stagnation point equilibrium radiative heat transfer)

A/NEREM, R. M.; B/STICKFORD, G. H. (AB/OHIO STATE U., DEPT. OF AERONAUTICAL AND ASTRONAUTICAL ENGINEERING, COLUMBUS, OHIO/.)

IN- AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, ENTRY TECHNOLOGY CONFERENCE, WILLIAMSBURG AND HAMPTON, VA., OCT. 12-14, 1964, TECHNICAL PAPERS /AIAA PUBLICATION CP-9/. NEW YORK, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, 1964, P. 158-169. 45 REFS.

/*EQUILIBRIUM FLOW/*HYPERSONIC REENTRY/*RADIATIVE HEAT TRANSFER/*SHOCK LAYER/*THERMAL RADIATION/ CONFERENCE/ EMISSION/ EQUILIBRIUM/ FLOW/ HEAT TRANSFER/ HIGH TEMPERATURE/ HYPERSONICS/ HYPERVELOCITY/ LAYER/ POINT/ RADIATION/ RATE/ REENTRY/ SHOCK/ SIMULATION/ STAGNATION/ THERMAL

A66-10784# ISSUE 1 PAGE 163 CATEGORY 33 AF 33/615/-2220 65/09/00 UNCLASSIFIED DOCUMENT

Radiating flows around re-entry bodies.

(Equilibrium radiative transport properties of high temperature air coupled with aerodynamic flow field generated by planetary reentry vehicles)

A/NEREM, R. M. (AA/OHIO STATE U., DEPT. OF AERONAUTICAL AND ASTRONAUTICAL ENGINEERING, COLUMBUS, OHIO/.)

INTERNATIONAL ASTRONAUTICAL FEDERATION, INTERNATIONAL ASTRONAUTICAL CONGRESS, 16TH, ATHENS, GREECE, SEP. 13-18, 1965, PAPER. 39 P. 89 REFS.

/*AERODYNAMIC HEAT TRANSFER/*HIGH TEMPERATURE AIR/*RADIATIVE HEAT TRANSFER/*REENTRY VEHICLE/*TRANSPORT PROPERTY/ AERODYNAMIC/ AIR/ COUPLING/ EQUILIBRIUM/ FIELD/ FLOW/ HEAT TRANSFER/ HIGH TEMPERATURE/ LAYER/ PLANETARY/ PROPERTY/ RADIATIVE/ REENTRY/ SHOCK/ STAGNATION/ TRANSPORT/ VEHICLE

A65-18101# ISSUE 8 PAGE 1041 CATEGORY 1 64/00/00 UNCLASSIFIED DOCUMENT

Radiation heating under hypersonic flow.

(Blunt body radiation heating from dissociated hot gas in shock layer formed by hypersonic flow)

A/BIBERMAN, L. M.; B/IAKUBOV, I. T.; C/NORMAN, G. E.; D/VOROBEV, V. S. (AD/MOSCOW INST. OF POWER ENGINEERING, MOSCOW, USSR/.)

ASTRONAUTICA ACTA, VOL. 10, NO. 3-4, 1964, P. 238-252. 49 REFS.

/*BLUNT BODY/*HYPERSONIC HEAT TRANSFER/ BLUNT/ BODY/ DISSOCIATED/ EMISSIVITY/ FLOW/ FLUX/ HEAT TRANSFER/ HEATING/ HOT GAS/ HYPERSONIC/ PRESSURE/ RADIANT HEATING/ RADIATION/ TEMPERATURE

A64-22474 ISSUE 18 CATEGORY 13 64/07/00 UNCLASSIFIED DOCUMENT

Heat transfer in hypersonic flow with radiation and chemical reaction.

(Combined effects of aerodynamic transport phenomena and radiative transport processes on heat transfer rate to hypersonic reentry vehicle)

A/SAMPSON, D. H.; B/SCALA, S. M. (AA/GENERAL ELECTRIC CO., SPACE SCIENCES LAB., VALLEY FORGE SPACE TECHNOLOGY CENTER, KING OF PRUSSIA, PA./.)

IN- SUPERSONIC FLOW, CHEMICAL PROCESSES AND RADIATIVE TRANSFER. EDITED BY D. B. OLFE AND V. Z AKKAY. OXFORD, ENGLAND, PUBLISHED FOR NATO AGARD, PERGAMON PRESS, LTD., NEW YORK, MACMILLAN CO., 1964, P. 319-354. 48 REFS. RESEARCH SUPPORTED BY THE GENERAL ELECTRIC INDEPENDENT RESEARCH PROGRAM.

/*AERODYNAMIC HEAT TRANSFER/*HEAT TRANSFER/*HYPERSONIC SPEED/*RADIATIVE HEAT TRANSFER/*REENTRY/ ATMOSPHERE/ BOUNDARY/ EQUATION/ FLOW/ LAYER/ PLANETARY/ RATE/ SHOCK/ VEHICLE/ WAVE

A64-17741 ISSUE 12 CATEGORY 13 64/00/00 UN CLASSIFIED DOCUMENT

Radiative heating of vehicles entering the earth's atmosphere.

(Equilibrium radiative heating of vehicles entering earth atmosphere at twice satellite velocity)

A/NICK, B. H. (AA/NASA, AMES RESEARCH CENTER, MOFFETT FIELD, CALIF./.)

IN- THE HIGH TEMPERATURE ASPECTS OF HYPERSONIC FLOW. EDITED BY WILBUR C. NELSON. /NATO, AGARD, SPECIALISTS' MEETING, TECHNICAL CENTRE FOR EXPERIMENTAL AERODYNAMICS, RHODE-SAINT-GENESE, BELGIUM, APR. 3-6, 1962./ NORTH ATLANTIC TREATY ORGANIZATION, ADVISORY GROUP FOR AERONAUTICAL RESEARCH AND DEVELOPMENT, AGARDOGRAPH 68. NEW YORK, MACMILLAN CO., OXFORD, PERGAMON PRESS, LTD., 1964, P. 607-626, DISCUSSION, P. 626, 627. 21 REFS.

/*ATMOSPHERIC ENTRY/*RADIATIVE HEAT TRANSFER/*REENTRY EFFECT/ ATMOSPHERE/ EFFECT/ ENTRY/ HEAT/ LAYER/ RADIATION/ REENTRY/ SHOCK/ TRANSFER

A63-19413 ISSUE 17 CATEGORY 13 63/07/00 UN CLASSIFIED DOCUMENT

(Lifting reentry vehicle cooling by reradiation from a constant-emissivity surface)

A/HANKEY, W. L., JR.; B/HOOKS, L. E.

CONSTANT CONVECTIVE HEATING RATE SURFACES FOR LIFTING RE-ENTRY VEHICLES. WILBUR L. HANKEY, JR., AND LAWRENCE E. HOOKS /USAF, AERONAUTICAL SYSTEMS DIVISION, WRIGHT-PATTERSON AFB, OHIO/. AIAA JOURNAL, VOL. 1, JULY 1963, P. 1533-1536.

/*CONVECTIVE HEAT TRANSFER/*HEAT TRANSFER/*LIFTING REENTRY/*RADIATION COOLING/*REENTRY VEHICLE/*SURFACE COOLING/ CONSTANT/ CONVECTION/ COOLING/ EMISSIVITY/ HEAT/ HEATING/ LIFT/ RADIATION/ REENTRY/ SURFACE/ TRANSFER/ VEHICLE

A63-17970 ISSUE 15 CATEGORY 13 63/06/00 UNCLASSIFIED DOCUMENT

(Surface temperature differences between elements of different emittances on a surface exposed to high-speed flow)

A/DRESSLER, F. R. S.

SURFACE TEMPERATURES DUE TO LOCALIZED REMOVAL OF A HIGHEMITTANCE COATING ON THE THIN-PLATE SECTIONS OF A RE-ENTRY VEHICLE. FRITZ R. S. DRESSLER /BALLISTIC RESEARCH LABS., ABERDEEN PROVING GROUND, MD./ AIAA JOURNAL, VOL. 1, JUNE 1963, P. 1416, 1417.

/*HEAT FLOW/ DIFFERENCE/ EMISSIVITY/ FLOW/ HEAT/ HIGH SPEED/ REENTRY/ SURFACE/ TEMPERATURE/ VEHICLE

N70-20979# ISSUE 8 CATEGORY 33 AD-697397 ARL-69-0145 F33615-68-C-1249 AF 33/615/-2220 69/09/00 UNCLASSIFIED DOCUMENT

Research on problems of high enthalpy flows Final report, 1 Oct. 1964 - 31 May 1969

(Simulated reentry physics emphasizing effects of radiative transfer in high temperature flow and convective heat transfer in high enthalpy boundary layers)

A/NEREM, R. M.

OHIO STATE UNIV., COLUMBUS. (AERONAUTICAL AND ASTRONAUTICAL RESEARCH LAB.) AVAIL. CFSTI WRIGHT-PATTERSON AFB, OHIO ARL

/*BOUNDARY LAYER TRANSITION/*CONVECTIVE HEAT TRANSFER/*FLIGHT SIMULATION/*RADIATIVE HEAT TRANSFER/*REENTRY PHYSICS/ ATMOSPHERIC ENTRY/ ENTHALPY/ LAMINAR BOUNDARY LAYER/ TURBULENT BOUNDARY LAYER

N70-18826*# ISSUE 7 PAGE 1362 CATEGORY 33
NASA-CR-1462 DAC-63243 NAS1-7757 00/00/00 UN
CLASSIFIED DOCUMENT
Stagnation point heat transfer during hypervelo
city atmospheric entry
(Stagnation point heat transfer during hypervel
ocity)
A/DIRLING, R. B., JR.; B/RIGDON, W. S.; C/THO
MAS, M.
MCDONNELL-DOUGLAS CO., SANTA MONICA, CALIF.
AVAIL. CFSTI
WASHINGTON NASA
/*ATMOSPHERIC ENTRY/*HYPERSONIC SPEED/*RADIATI
VE HEAT TRANSFER/*STAGNATION POINT/ ABLATION/ THER
MODYNAMIC PROPERTIES/ TRANSPORT PROPERTIES

N68-35248*# ISSUE 22 PAGE 3977 CATEGORY 33
NASA-CR-1170 NAS1-7757 68/09/00 UNCLASSIFIE
D DOCUMENT
Radiative and convective heating during atmosph
eric entry
(Radiative and convective heating during atmosp
heric entry)
A/DIRLING, R. B., JR.; B/RIGDON, W. S.; C/THO
MAS, M.
DOUGLAS AIRCRAFT CO., INC., SANTA MONICA, CALIF
. AVAIL. CFSTI
WASHINGTON NASA
/*ATMOSPHERIC ENTRY/*CONVECTIVE HEAT TRANSFER/
*RADIATIVE HEAT TRANSFER/ APPROXIMATION/ BLUNT BOD
IES/ BOUNDARY LAYER FLOW/ GRAPHS (CHARTS)/ MATHEMA
TICAL MODELS/ STAGNATION POINT/ TABLES (DATA)

N68-10017* ISSUE 1 PAGE 146 CATEGORY 33 NA
SA-CR-66471 AVSSD-0007-67-RR NAS1-5786 67/11/0
8 UNCLASSIFIED DOCUMENT
Heat transfer calculations for high speed reent
ry Final report
(Heat transfer distributions for blunt cones re
entry into earth atmosphere)
A/BUSS, H.; B/CZUMAK, F.; C/GIBSON, W.; D/PA
LLONE, A.; E/STEIN, E.
AVCO CORP., WILMINGTON, MASS. (RESEARCH AND T
ECHNOLOGY LABS.) AVAIL. CFSTI

/*EARTH ATMOSPHERE/*HEAT TRANSFER/*REENTRY EFF
ECTS/ ABLATION/ BOUNDARY LAYER FLOW/ CONES/ EMISSI
VITY/ ENTROPY/ FLOW DISTRIBUTION/ HEAT SHIELDING/
REENTRY PHYSICS

X70-13353*# ISSUE 9 PAGE 664 CATEGORY 33 N
ASA-CR-109286 NASW-1587 68/06/00 UNCLASSIFIE
D DOCUMENT GOVT. AGCY. ONLY
Study of absorption and radiative coupling in h
ypervelocity flows
(Heat absorption and radiative transfer effects
on reentry vehicles at superorbital flight veloci
ties)
GENERAL ELECTRIC CO., PHILADELPHIA, PA. (MISS
ILE AND SPACE DIV.)

/*HEAT SHIELDING/*RADIATIVE HEAT TRANSFER/*REE
NTRY VEHICLES/ GRAPHS (CHARTS)/ LABORATORY EQUIPME
NT/ MATHEMATICAL MODELS/ SHOCK WAVES/ SPACECRAFT D
ESIGN/ SURFACE COOLING/ THERMODYNAMIC PROPERTIES

GROUP 7

Concerning reentry simulation techniques and facilities.

A65-29084*# ISSUE 18 PAGE 2633 CATEGORY 11
65/00/00 UNCLASSIFIED DOCUMENT

Convective and radiative heat transfer during reentry and advanced techniques for their simulation.

(Convective and radiative heat transfer simulation, describing use of shock tubes and ballistic ranges and combinations thereof)

A/CANNING, T. N. (AA/NASA, AMES RESEARCH CENTER, MOFFETT FIELD, CALIF./.)

IN- CONFERENCE ON THE ROLE OF SIMULATION IN SPACE TECHNOLOGY, VIRGINIA POLYTECHNIC INST., BLACKSBURG, VA., AUG. 17-21, 1964, PROCEEDINGS. /CIRCULAR NO. 4, PART B/. <A65-29082 18-11< CONFERENCE SUPPORTED BY NASA AND NSF. BLACKSBURG, VA., VIRGINIA POLYTECHNIC INST., 1965, P. VII-1 TO VII-27. 19 REFS.

/*CONVECTIVE HEAT TRANSFER/*RADIATIVE HEAT TRANSFER/*THERMAL SIMULATION/ BALLISTICS/ CONFERENCE/ CONVECTION/ HEAT TRANSFER/ RADIATION/ RANGE/ REENTRY/ SHOCK/ SIMULATION/ THERMAL/ TUBE

A63-16884* ISSUE 13 CATEGORY 10 62/00/00 UNCLASSIFIED DOCUMENT

(Description of ames entry heating simulator, a facility which is capable of simulating both the convective and radiative modes of heat transfer)

A/LUNDELL, J. H.; B/WAKEFIELD, R. M.; C/WINOVICH, W.

SIMULATION OF CONVECTIVE AND RADIATIVE ENTRY HEATING. JOHN H. LUNDELL, WARREN WINOVICH, AND ROY M. WAKEFIELD /NASA, AMES RESEARCH CENTER, MOFFETT FIELD, CALIF./ /UNIVERSITY OF DENVE, DENVER RESEARCH INSTITUTE, SYMPOSIUM ON HYPERVELOCITY TECHNIQUES, 2ND, PROCEEDINGS, DENVER, COLO., MAR. 20, 21, 1962./ IN- ADVANCES IN HYPERVELOCITY TECHNIQUES. NEW YORK, PLENUM PRESS, INC., 1962, P. 729-748.

/*HEAT TRANSFER/*RADIATIVE HEAT TRANSFER/*REENTRY EFFECT/*SIMULATOR/*SPACE SIMULATOR/ ABLATION/ CONVECTION/ ENTRY/ FLUX/ GAS/ HEAT/ HEATING/ HYPERSONICS/ RADIATIVE/ RAREFACTION/ REENTRY/ RESULT/ SPACE/ TEST/ THERMOCONDUCTIVITY/ THERMOCOUPLE/ TRANSFER

N69-34611*# ISSUE 20 PAGE 3776 CATEGORY 12
NASA-TT-F-12376 69/08/00 UNCLASSIFIED DOCUMEN
T
Radiative heat exchange during flow of a gas th
rough a tube
(Radiative heat exchange during gas flow throug
h tubes)
A/VETLUTSKIY, V. N.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION,
WASHINGTON, D. C. AVAIL. CFSTI
TRANSL. INTO ENGLISH FROM ZH. PRIKL. MEKHAN
. I TECHN. FIZ. /MOSCOW/, NO. 5, 1968 P 82-88
/*GAS FLOW/*RADIATIVE HEAT TRANSFER/*TUBE HEAT
EXCHANGERS/ ABSORPTIVITY/ APPROXIMATION/ HIGH PRE
SSURE/ HIGH TEMPERATURE RESEARCH/ HYDROGEN/ REAL G
ASES/ TEMPERATURE PROFILES/ U.S.S.R.

N69-18972*# ISSUE 8 PAGE 1320 CATEGORY 11
NASA-CR-100138 NASR-226 65/00/00 UNCLASSIFIE
D DOCUMENT
Proceedings of the Conference on the Role of Si
mulation in Space Technology, part B
(Simulation studies and facilities for atmosphe
ric reentry at hypersonic speeds)
VIRGINIA POLYTECHNIC INST., BLACKSBURG. AVAI
L. CFSTI
ITS ENG. EXTENSION SER. CIRC. NO. 4 MEETING
HELD 17-21 AUG. 1964
/*ATMOSPHERIC ENTRY SIMULATION/*CONFERENCES/*H
YPERSONIC FLIGHT/*REENTRY EFFECTS/*TEST FACILITIES
/ ABLATIVE MATERIALS/ AERODYNAMIC CHARACTERISTICS/
CONVECTIVE HEAT TRANSFER/ FLIGHT SIMULATION/ FLIG
HT TESTS/ GROUND TESTS/ HEAT SHIELDING/ RADIATIVE
HEAT TRANSFER/ REENTRY COMMUNICATION/ SHOCK TUBES/
WIND TUNNELS

X70-13954#q ISSUE 10 PAGE 737 CATEGORY 33 A
D-864774 AFML-TR-69-238 F33615-68-C-1420 69/06
/00 UNCLASSIFIED DOCUMENT GOVT. AGCY. ONLY
Feasibility of thermal radiative property measu
rements under simulated reentry conditions Final
report
(Simulated reentry thermal radiative property m
easurements)
A/KAY, R. B.; B/KNEISSL, G. J.
DUNN ASSOCIATES, INC., SILVER SPRING, MD.
WRIGHT-PATTERSON AFB, OHIO AFML
/*ATMOSPHERIC ENTRY SIMULATION/*REENTRY EFFECT
S/*THERMAL RADIATION/*THERMODYNAMIC PROPERTIES/ AN
ALYSIS (MATHEMATICS)/ EMITTANCE/ HEAT SHIELDING/ P
LASMA RADIATION/ SURFACE TEMPERATURE/ TEMPERATURE
MEASUREMENT/ THERMAL SIMULATION

GROUP 8

Concerning the design and performance of high temperature heat shields.

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. 045518

AD-870 287 11/2 20/13
GRUMMAN AIRCRAFT ENGINEERING CORP BETHPAGE N Y RESEARCH DEPT
EMITTANCE PROPERTY RESEARCH ON THERMAL SHIELDS FOR SPACE SHUTTLE. (U)
DESCRIPTIVE NOTE: RESEARCH MEMO.,
MAY 70 18P REICHMAN,J. I
REPT. NO. RM-478

UNCLASSIFIED REPORT
DISTRIBUTION: DDC USERS ONLY.

DESCRIPTORS: (*CERAMIC MATERIALS, *EMISSIVITY), HEAT SHIELDS, THERMAL RADIATION, HEAT FLUX, TRANSITION ELEMENTS, RARE EARTHS, IONS, ADDITIVES, ABSORPTION, REFLECTION, SURFACE PROPERTIES, POROSITY, MICROSTRUCTURE, RENDEZVOUS SPACECRAFT, REENTRY VEHICLES, ATMOSPHERE ENTRY, AERODYNAMIC HEATING (U)
IDENTIFIERS: *EMITTANCE, REUSABLE SPACECRAFT, REFLECTANCE (U)

THE HIGH TEMPERATURE EMITTANCE OF THE CERAMIC MATERIALS IN CONSIDERATION FOR USE AS A RE-ENTRY SHIELD FOR THE SPACE SHUTTLE IS ABOUT 0.4. IT IS MOST DESIRABLE TO INCREASE THIS EMITTANCE BY A FACTOR OF TWO. TO ACHIEVE THIS OBJECTIVE, MORE KNOWLEDGE IS REQUIRED CONCERNING THE SCATTERING AND ABSORPTION OF RADIATION IN A CERAMIC MATERIAL. A RESEARCH PROGRAM TO PROVIDE THIS INFORMATION IS DESCRIBED IN THIS MEMORANDUM. A METHOD THAT APPEARS PROMISING, THAT OF INCREASING THE EMITTANCE BY ADDING TRANSITION METAL AND/OR RARE EARTH ION IMPURITIES, IS DISCUSSED. BACKGROUND INFORMATION IS PROVIDED TO GIVE A QUALITATIVE AND QUANTITATIVE UNDERSTANDING OF THE RELATIONSHIP OF EMITTANCE TO THE PHYSICAL AND MICROSCOPIC PROPERTIES OF THE CERAMIC MATERIAL. (AUTHOR) (U)

A68-44964# ISSUE 24 PAGE 4617 CATEGORY 18
AIAA PAPER 68-1128 68/10/00 UNCLASSIFIED DOCUM
ENT

Refractory materials and insulation.

(Refractory materials for radiation cooled heat shields, discussing ceramics use for high tempera ture areas of hypersonic cruise and lifting reentr y vehicles)

A/BILOW, G. B.; B/KUMMER, D. L. (AA/MCDONNEL L DOUGLAS CORP., ST. LOUIS, MO./.) MEMBERS, $1.0 0, NONMEMBERS, $1.50.

NEW YORK, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS. AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, ANNUAL MEETING AND TECHNICAL DISPLAY , 5TH, PHILADELPHIA, PA., OCT. 21-24, 1968.

/*HEAT SHIELDING/*HIGH TEMPERATURE RESEARCH/*R ADIATIVE HEAT TRANSFER/*REFRACTORY MATERIALS/*THER MAL INSULATION/ BORIDES/ CARBIDES/ CERAMICS/ CONFE RENCES/ OXIDES/ REFRACTORY METALS/ SHOCK RESISTANC E

A68-44952# ISSUE 24 PAGE 4680 CATEGORY 31
AIAA PAPER 68-1127 68/10/00 UNCLASSIFIED DOCUM
ENT

Review of structural and heat-shield concepts f or future re-entry spacecraft.

(Ablative and radiative heat shield and hot and cold structural approaches for reentry spacecraft compared for hypersonic lift drag range)

A/MCCOWN, J. W. (AA/MARTIN MARIETTA CORP., AE ROSPACE GROUP, FLIGHT TECHNOLOGY DEPT., DENVER, CO LO./.) MEMBERS, $1.00, NONMEMBERS, $1.50.

NEW YORK, AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS. AMERICAN INST. OF AERONAUTICS AND ASTRONAUTICS, ANNUAL MEETING AND TECHNICAL DISPLAY , 5TH, PHILADELPHIA, PA., OCT. 21-24, 1968.

/*HEAT SHIELDING/*HYPERSONIC SPEED/*LIFT DRAG RATIO/*REENTRY VEHICLES/*SPACECRAFT SHIELDING/*SPA CECRAFT STRUCTURES/ ABLATIVE MATERIALS/ CONFERENCE S/ RADIATIVE HEAT TRANSFER/ STRUCTURAL DESIGN/ TEC HNOLOGY UTILIZATION

A68-24255# ISSUE 10 PAGE 1910 CATEGORY 33
AIAA PAPER 68-300 68/04/00 UNCLASSIFIED DOCUME
NT

A study of advanced thermal protection systems.

(Thermal protection systems and heat shield mat
erials for planetary entry heating noting heat sin
ks, transpiration and film cooling and radiative a
nd ablative cooling)

A/ROSSI, J. J.; B/SONES, P. D. (AA/RAYTHEON
CO., SPACE AND INFORMATION SYSTEMS DIV., SUDBURY,
MASS./.)

NEW YORK, AMERICAN INST. OF AERONAUTICS AND
ASTRONAUTICS. AMERICAN INST. OF AERONAUTICS AND
ASTRONAUTICS, AND AMERICAN SOCIETY OF MECHANICAL E
NGINEERS, STRUCTURES, STRUCTURAL DYNAMICS AND MATE
RIALS CONFERENCE, 9TH, PALM SPRINGS, CALIF., APR.
1-3, 1968.

/*ATMOSPHERIC ENTRY/*COOLING SYSTEMS/*REENTRY
SHIELDING/*THERMAL PROTECTION/ ABLATIVE MATERIALS/
CONFERENCES/ FILM COOLING/ HEAT SINKS/ RADIANT CO
OLING/ RADIATIVE HEAT TRANSFER/ SPACECRAFT CONFIGU
RATIONS/ TRANSPIRATION

A65-32981 ISSUE 21 PAGE 3136 CATEGORY 18 6
5/08/21 UNCLASSIFIED DOCUMENT

Evaporation of silicon from molybdenum silicide
s at high temperature and in hard vacuum.

(High temperature degradation of molybdenum dis
ilicide coatings on molybdenum in hard vacuum via
silicon loss by successive transformation)

A/BLAIR, G. R.; B/LEVIN, H.; C/OBRIEN, R. E.
(AB/HUGHES AIRCRAFT CO., COMPONENTS AND MATERIAL
S LAB., CULVER CITY, CALIF./, AC/NORTH AMERICAN AV
IATION, INC., SPACE AND INFORMATION SYSTEMS DIV.,
DOWNEY, CALIF./.)

AMERICAN CERAMIC SOCIETY, JOURNAL, VOL. 48,
AUG. 21, 1965, P. 430-432.

/*HIGH TEMPERATURE MATERIAL/*MOLYBDENUM COMPOU
ND/*PROTECTIVE COATING/*THERMAL DEGRADATION/*VACUU
M EFFECT/ COATING/ COMPOUND/ DEGRADATION/ DIFFUSIO
N/ DISILICIDE/ EFFECT/ EMISSIVITY/ ENVIRONMENT/ HI
GH TEMPERATURE/ MATERIAL/ MOLYBDENUM/ PROTECTION/
SILICIDE/ THERMAL/ TRANSFORMATION/ VACUUM

A64-26669# ISSUE 23 CATEGORY 13 00/00/00 U
NCLASSIFIED DOCUMENT
Experimental investigation of a charring ablati
ve material exposed to combined convective and rad
iative heating in oxidizing and nonoxidizing envir
onments.
(Charring ablative materials effectiveness in c
ombined convective and radiative heating as reentr
y shield)
A/JONES, J. W.; B/LUNDELL, J. H.; C/WAKEFIELD
, R. M. (AA/NASA, AMES RESEARCH CENTER, MOFFETT
FIELD, CALIF./.)
IN- AMERICAN INST. OF AERONAUTICS AND ASTRON
AUTICS, ENTRY TECHNOLOGY CONFERENCE, WILLIAMSBURG
AND HAMPTON, VA., OCT. 12-14, 1964, TECHNICAL PAPE
RS /AIAA PUBLICATION CP-9/. NEW YORK, AMERICAN INS
T. OF AERONAUTICS AND ASTRONAUTICS, 1964, P. 216-2
27. 15 REFS.
/*ABLATING MATERIAL/*CONVECTIVE HEAT TRANSFER/
*MATERIAL TESTING/*RADIATIVE HEAT TRANSFER/*REENTR
Y SHIELD/ ABLATION/ CONFERENCE/ CONVECTION/ ENVIRO
NMENT/ HEAT TRANSFER/ HEATING/ MAGNITUDE/ MATERIAL
/ MEASUREMENT/ OXIDIZER/ RADIATION/ REENTRY/ SHIEL
D/ TEST

N69-10899# ISSUE 1 PAGE 7 CATEGORY 1 ARC-R
/M-3540 RAE-TR-66311 ARC-28924 68/00/00 UNCLAS
SIFIED DOCUMENT
Alleviation of leading-edge heating by conducti
on and radiation
(Alleviating leading edge heating of hypersonic
aircraft by conductive and radiative heat transfe
r)
A/CAPEY, E. C.
AERONAUTICAL RESEARCH COUNCIL /GT. BRIT./ AV
AIL. CFSTI

/*CONDUCTIVE HEAT TRANSFER/*HYPERSONIC AIRCRAF
T/*LEADING EDGES/*RADIATIVE HEAT TRANSFER/ AERODYN
AMIC HEATING/ ANGLE OF ATTACK/ SURFACE TEMPERATURE
/ TEMPERATURE DISTRIBUTION
SUPERSEDES+RAE-TR-66311, ARC-28924+
TYPE: 3

N68-31427# ISSUE 19 PAGE 3377 CATEGORY 32
GDC-ERR-AN-1133 67/12/00 UNCLASSIFIED DOCUMENT

Lightweight radiative heat shield development
(Design, development, and testing lightweight r adiative heat shield for maneuverable reentry vehi cle)
A/BLACK, W. E.
GENERAL DYNAMICS/CONVAIR, SAN DIEGO, CALIF.

/*RADIATIVE HEAT TRANSFER/*REENTRY SHIELDING/* STRUCTURAL DESIGN/*THERMAL CYCLING TESTS/*THERMAL PROTECTION/ AERODYNAMIC HEATING/ HASTELLOY (TRADEM ARK)/ HIGH TEMPERATURE TESTS/ NIOBIUM ALLOYS/ PERF ORMANCE TESTS

X69-18647# ISSUE 21 PAGE 1619 CATEGORY 18
GDC-ERR-1272 69/02/00 UNCLASSIFIED DOCUMENT
GOVT. AGCY. ONLY
Radiative thermal protection systems developmen t for maneuverable reentry spacecraft
(Radiative thermal protection system for maneuv erable reentry spacecraft)
A/BLACK, W. E.
GENERAL DYNAMICS/CONVAIR, SAN DIEGO, CALIF.

/*MANEUVERABLE SPACECRAFT/*RADIATIVE HEAT TRAN SFER/*REENTRY VEHICLES/*THERMAL PROTECTION/ COSTS/ HASTELLOY (TRADEMARK)/ HEAT SHIELDING/ LEAKAGE/ N IOBIUM ALLOYS/ WEIGHT (MASS)

N66-33307*# ISSUE 19 PAGE 3893 CATEGORY 33
NASA-TM-X-784 63/03/00 UNCLASSIFIED DOCUMENT

Preliminary evaluation of a number of ablative heat-shield materials exposed to combined radiativ e and convective heating

(Ablating materials tested at combined radiativ e and convective heating for manned reentry vehicl e heat shields)

A/DICKEY, R. R.; B/HAACKER, J. F.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. AMES RESEARCH CENTER, MOFFETT FIELD, CALIF. AVA IL. CFSTI

WASHINGTON, NASA, MAR. 1963 72 P REFS

/*ABLATING MATERIAL/*CONVECTIVE HEAT TRANSFER/ *HEAT SHIELD/*RADIATIVE HEAT TRANSFER/*REENTRY VEH ICLE/ ABLATION/ BALSA/ CONVECTION/ CORK/ FLUX/ HEA T/ HEAT TRANSFER/ MANNED/ MATERIAL/ POINT/ RADIATI VE/ REENTRY/ SHIELD/ SPACECRAFT/ STAGNATION/ VEHIC LE/ WOOD

/DECLASSIFIED/

N66-21104# ISSUE 10 PAGE 1773 CATEGORY 32
ML-TDR-64-204, VOL. I AD-627139 AF 33/657/-9407
06/04/00 UNCLASSIFIED DOCUMENT

Evaluation of thermal protective systems for ad vanced aerospace vehicles, volume I Interim summar y report, Sep. 1962 - Dec. 1963

(Thermal protective systems for advanced aerosp ace vehicles - thermal and mechanical properties o f refractory materials)

A/BLITON, J. L.; B/CHRISTIAN, W. J.; C/DALLY, J. W.; D/HEDGE, J. C.; E/HIRSCHHORN, H. J.

IIT RESEARCH INST., CHICAGO, ILL. AVAIL. CFS TI

WRIGHT-PATTERSON AFB, OHIO, AF MATER. LAB., APR. 1965 259 P REFS

/*AEROSPACE VEHICLE/*MECHANICAL PROPERTY/*REFR ACTORY MATERIAL/*THERMAL PROTECTION/ AEROSPACE/ AL LOY/ ALUMINUM/ CERMET/ CHROMIUM/ COATING/ COMPATIB ILITY/ CONDUCTIVITY/ COOLING/ EMISSIVITY/ EVAPORAT ION/ EXPANSION/ FLAME/ HIGH TEMPERATURE/ MATERIAL/ MECHANICAL/ MEDIUM/ NICKEL/ PLASMA/ PROPERTY/ PRO TECTION/ RADIATION/ REFRACTORY/ SPRAYING/ THERMAL/ TRANSPIRATION/ VEHICLE

N63-16058 ISSUE 13 CATEGORY 34 61/07/25 UNCLASSIFIED DOCUMENT

(High temperature composite structural configurations - radiative thermal protection systems for 2500 to 4500-deg f)

A/GUYTON, R. D.

AERONAUTICAL SYSTEMS DIV. FLIGHT DYNAMICS LAB., WRIGHTPATTERSON AFB, OHIO HIGH-TEMPERATURE COMPOSITE STRUCTURAL CONFIGURATIONSRADIATIVE THERMAL PROTECTION SYSTEMS FOR 2500 DEG TO 4500 DEG F ROBERT D. GUYTON IN LITTLE /ARTHUR D./, INC., CAMBRIDGE, MASS. PROC. OF <AFOSR< CONF. ON AERODYNAMICALLY HEATED STRUCTURES, CAMBRIDGE, MASS., JULY 25, 1961 P 151-170 /SEE N63-16051 13-13/ /AF PROJ. ASSET/

/*AERODYNAMIC HEATING/*COMPOSITE STRUCTURE/*RADIATIVE HEAT TRANSFER/*THERMAL INSULATION/*THERMAL PROTECTION/ AERODYNAMIC/ COMPOSITE/ CONDUCTIVITY/ COOLING/ EMISSIVITY/ HEAT TRANSFER/ HEATING/ HIGH TEMPERATURE/ INSULATION/ METAL/ RADIATIVE/ REENTRY/ REFRACTORY/ STRUCTURE/ TANTALUM/ THERMAL/ TUNGSTEN

X65-13612 ISSUE 9 PAGE 665 CATEGORY 33 AF 33/616/-8106 64/00/00 UNCLASSIFIED DOCUMENT GOVT. AGCY. ONLY

Heat protection by radiative heat rejection

(Lifting reentry vehicle heat protection by radiative heat rejection)

A/MARKS, C. D.

MCDONNELL AIRCRAFT CORP., ST. LOUIS, MO.

17 JUL. 1964 IN AEROSPACE CORP. TRANS. OF THE 9TH SYMP. ON BALLISTIC MISSILE AND SPACE TECHNOL., VOL. II <1964< P 267-295 /SEE X65-13603 09-34/

/*HEAT REJECTION DEVICE/*LIFTING BODY/*RADIATIVE HEAT TRANSFER/*REENTRY VEHICLE/ BODY/ CONFIGURATION/ DEVICE/ HEAT/ HEAT TRANSFER/ HYPERSONIC/ LIFTING/ MATERIAL/ METAL/ MISSION/ RADIATIVE/ REENTRY/ REJECTION/ STRUCTURE/ TRANSFER/ VEHICLE

X64-14575# ISSUE 15 CATEGORY 13 ER-13462 FDL -TDR-64-78 AD-440432 AF 33/657/-10206 64/06/01

UNCLASSIFIED DOCUMENT GOVT. AGCY. ONLY

Ablative composites for superorbital glide re-e ntry technical documentary report, apr. 1963 - ap r. 1964

(Ablative composite radiative heat shield for s uperorbital glide reentry)

A/DAVIS, R. M.; B/MATRA, J. P., JR.; C/MILEWS KI, C.

MARTIN CO., BALTIMORE, MD. (RESEARCH DEPT.)

WRIGHT-PATTERSON AFB, OHIO, AF FLIGHT DYN. L AB., 1 JUN. 1964 212 P REFS

/*ABLATING MATERIAL/*COMPOSITE MATERIAL/*HEAT SHIELD/*RADIATIVE HEAT TRANSFER/ ABLATION/ COMPOSI TE/ GLIDE/ HEAT TRANSFER/ MATERIAL/ RADIATIVE/ REE NTRY/ SHIELD/ SUPERORBITAL